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ABSTRACT

This study was designed to arrive at a possible consensus of expert opinions as related to teacher use of library media centers in American public education, and to analyze the essential teacher skills and knowledge suggested by the experts through this systematic methodology. This provided a national needs assessment to serve as a basis for future instructional development in the area of effective teacher use of library media centers. Delphi and Fault Tree analysis were used in combination as the systematic methodology. A 58-item checklist was created from the Delphi phase of the study and the initial input from the national panel of experts was used to qualify a fault tree. The prime strategic path for effective teacher use of library media centers was determined to be ineffective use of existing learning resources because of failure to use production specialists effectively. The function of the production specialist was defined as using the specifications developed in the design function either to create resources or to locate appropriate existing materials. Other areas of study included inservice training, specifications of learning objectives, effective use of reference books, goals and policies about roles and purposes, evaluation, and selection of learning resources. (Author/JEG)

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The NATUL Project

TEACHER USE OF LIBRARY MEDIA CENTERS IN THE FUTURE:

A National Needs Assessment By Use of Delphi-Fault Tree Analysis For Instructional Development

By

Rulon Kent Wood

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TEACHER USE OF LIBRARY MEDIA CENTERS IN THE FUTURE:
A NATIONAL NEEDS ASSESSMENT BY USE OF DELPHI-FAULT TREE ANALYSIS
FOR INSTRUCTIONAL DEVELOPMENT

ABSTRACT

The major purpose of this study was to discover a possible consensus of expert opinions as related to teacher use of library media centers in American public education. A subsumed purpose included analysis of essential teacher skills and knowledge as suggested by the experts through a systematic methodology. This provided a national needs assessment to give a basis for future instructional development in the area of effective teacher use of library media centers.

Delphi and Fault Tree Analysis were used in combination as the systematic methodology. A fifty-eight item checklist was created from the Delphi phase of the study and the initial input from the national panel of experts was utilized to qualify (draft) a fault tree. The fault tree produced was quantified (ranked) by a local panel of experts from the Utah State University Department of Instructional Media. The prime strategic path for effective use of library media centers by teachers (those factors which were judged as most adversely affecting the improvement of teacher use of library media centers) was determined to be ineffective use of existing learning resources because of failure to effectively use production specialists. The production specialists function was defined as taking the specifications developed in the design function and to either create the resources, or if they already exist to locate them rather than produce the resources. Other strategic paths focused on inservice training, specifications of learning objectives, effective use of reference books, goals and policies about roles and purposes, evaluation, and selection of learning resources.

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Chapter 1

INTRODUCTION

The classroom teacher determines, in large part, students' use or non-use of library media centers (LMCs) in the schools. El-Hagrasy established a positive relationship between teachers' library media center background and students' gain in LMC usage and reading.[1] Another expert suggested this same relationship of teacher knowledge and LMC skills to students' use and presented data showing secondary school teachers were inadequately prepared to effectively use the LMC as a tool of education.[2]

Perkins, using a population of more than four thousand college seniors enrolled in student teaching courses in sixty-nine colleges from thirty-eight states, presented data from standardized library use scores and concluded that because teachers were ill prepared to use library media centers "the greatest potential source of education for today's youth, the library, is being wasted."[3]

---

[1]Saad M. El-Hagrasy, "The Teacher's Role in Library Service: An Investigation and Its Devices" (unpublished Doctoral dissertation, Rutgers, the State University, 1961).

[2]Sister Mary Peter Cleaver Ducat, "Student and Faculty Use of the Library in Three Secondary Schools" (unpublished Doctoral dissertation, Columbia University, 1960).

[3]Ralph Perkins, The Prospective Teachers' Knowledge of Library Fundamentals (New York: Scarecrow Press, 1961), p. 199.

In a more limited study of teacher use of LMCs, Walker administered a brief questionnaire to eighty-five student teachers serving in several Chicago suburban schools and some serving in an Oregon High School. He concluded after analysis of the collected data the "student teachers have, at best, very limited knowledge of library resources available to them and that much of what they think they have is incorrect."[4] In another study done by Walker, 109 teachers and nine librarians were surveyed. The findings showed that ninety percent of those questioned agreed that:[5]

1. Many teachers don't use the library and its facilities effectively.
2. Instruction in effective use of the library should be given as part of teacher's preservice training.
3. Teachers would use the library more effectively if they knew more about what resources are available and how to locate them.

Another investigator of teacher use of LMCs stated:[6]

> Modern teaching methods and new curricular developments in elementary and secondary education necessitate the use of a variety of materials to facilitate the learning experience of students, and to provide for individual differences in ability and interest. Since there is currently available an increasingly large and varied volume of materials from which to choose, it is of vital importance that teachers possess skills in selecting, evaluating, and utilizing the role of the library media center in the total educational program.

---

[4]Jerry L. Walker, "What Do Student Teachers Know About Librarians?" School Libraries, XVII (Winter, 1967), p. 18.

[5]Jerry L. Walker, "Changing Attitudes Toward the Library and the Librarian," American Library Association Bulletin, LXI (September, 1967), pp. 977-979.

[6]Evelyn J. Swenson, "Library Science Training in Teacher Education," Journal of Education for Librarianship, VIII (Winter, 1968), p. 168.

Swenson surveyed 178 colleges and universities which were identified as having teacher education programs and programs in library science. Some seventy percent of these institutions indicated no courses were offered for education majors to acquaint these students with school library media centers. Only six of the 178 schools surveyed required such a course of their prospective teachers although seventy-eight percent of the schools agreed that a course dealing with the library media center and its resources was necessary.[7]

Other investigators have explored the problem of teacher use of library media centers.[8,9,10,11] A great deal has been discovered as to the need for improved knowledge and skills of teachers in using the LMCs, but no study to date has focused upon a suitable methodology to design a curriculum in a systematic way.

In a recent book the author reviews the general needs of teachers in using LMCs, identifying as early as 1930 a National Education Association subcommittee report which asked "whether the professional

---

[7] Ibid., p. 184.

[8] Charlene A. Swenson, "An Approach to an In-Service Program to Develop the Concept of the School Library as Part of the Instructional System" (unpublished doctoral dissertation, Wayne State University, 1968).

[9] Lowell Ellis Dixon, "Teachers', Principals', and Librarians' Perceptions of the School Librarians' Role" (unpublished doctoral dissertation, University of Minnesota, 1968).

[10] Ernest Kay, Teachers, Librarians, and Children: A Study of Libraries in Education (London, Conn.: Bingley Books, 1967).

[11] Paul B. F. Wild, "Teacher Education and School Libraries," School Libraries, XVII (October, 1967), pp. 37-40.

training of teachers had not yet reached a period in its development when the library must be one of the factors in the training of pupil teachers."[12] After making an historical review, he states the following as the status of teachers in using LMCs:[13]

> How can students make use of the sources which will intensify their knowledge of a subject unless teachers know what the sources are and will direct students to them? And what of the teacher's own need to keep abreast of new knowledge in his own field?
>
> The lack of a basic orientation to the function of a school library is regrettable, for it is the teacher who must recognize or create the conditions which lead to constructive use of the school library. Unless teachers perform in such a way as to compel students to seek out library resources, the library will be largely unused or become little more than a study hall. In this case, teachers must bear the blame for the waste of money and effort and the lost opportunity which a near-empty library represents.
>
> The school library offers the teachers a method of so individualizing instruction as to give each student a job which he can do, using materials he can understand. It is the perfect instrument for combating the evils of mass education. It provides the student with a convenient learning environment, where he can proceed at his own pace, and receive sympathetic professional help when he needs it.
>
> A breakthrough in the preparation of classroom teachers vis-a-vis the school library is sorely needed. It is only too true that teachers come into the profession without any understanding of the school library as a medium of instruction.

Another author makes a strong proposal for a course in teacher use of LMCs:[14]

> Inadequate teacher library education has contributed to students' inability to study independently, which in the last analysis is a measure of quality education. To strengthen teacher education,

---

[12] Martin Rossoff, The School Library and Educational Change (Littleton, Colorado: Libraries Unlimited, 1971), p. 12. Rossoff had earlier published The Library in High School Teaching (New York: H. W. Wilson, 1955) and a second edition of the same book in 1961.

[13] Ibid.

[14] Louis Shores, "Design for Teacher Education in Instructional Materials," in Library Education (Littleton, Colorado: Libraries Unlimited, 1972), pp. 128-132. Shores also published Instructional Materials: An Introduction for Teachers (New York: Ronald Press, 1960).

> a program that would integrate the scattered and often incidental orientations in elective, and required library sciences, audio-visual, and children's literature courses is here proposed.

Davies treats the subject in detail, summarizing the needs of school library media centers in American public education. She suggests that:[15]

> As a library program becomes meaningful, it is more closely identified with the total instructional program, so that its ultimate success is really to put itself, as a separate program, out of business. . . .
>
> A quality school library program is an instrument for educational excellence. The "educational program is strengthened in direct proportion to the quality of the schools library service" for the school library is the "keystone of a quality educational program."

Authors who treat the subject of teacher use of library media centers identify the need for instructional programs, but do little to develop a curriculum in terms of specific needs assessment as a part of instructional development.

One of the few to identify needs assessment in the area of teacher use of library media centers is Nancy Polette. She summarizes recent research on the topic of inservice training for teachers in using media centers, suggesting local needs assessment as one of the keys to the successful program,[16] but no study reviewed to date has suggested a national needs assessment.

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[15]Ruth Ann Davies, The School Library; A Force For Educational Excellence (New York: R. R. Bowker, 1969), p. 17.

[16]Nancy Polette, In-Service: School Library/Media Workshops and Conferences (Metuchen, N. J.: Scarecrow Press, 1973).

STATEMENT OF THE PROBLEM

The problem of this study was to conduct a national needs assessment: (1) which would discover possible consensus of expert opinions as related to teacher use of library media centers in American public education; and (2) to analyze the required teacher skills and knowledge suggested by these experts by a systematic methodology; and finally (3) to develop a basis for recommending future design and instructional development for teachers learning to utilize library media centers effectively as a prime tool in the teaching-learning process.

SIGNIFICANCE

It is intended that the results of the study will: (1) provide pertinent information to educational administrators for use in planning more efficient and effective use of library media centers by teachers; and (2) provide guidelines for teacher education programs as to knowledge and skills necessary for teachers in using library media centers effectively; and (3) serve as a basis to design and evaluate a new methodology for national instructional development projects by combining Fault Tree Analysis and Delphi Techniques.

DELIMITATIONS

From more than four hundred leaders recommended by nationally accredited schools of Education, Librarianship and State Departments of Public Instruction, thirty-six persons were selected to serve on the panel of experts for the study. The experts were drawn from all of the ten federal regions of the United States as designated by the U. S.

Office of Education, except region two which includes the Virgin Islands, Puerto Rico and the state of New York. A map of the regions and the distribution of membership of the national panel of experts is shown in figure 1 on page 8. A listing of the national panel members is found in appendix A. In addition to the national panel, a local panel of experts from the Utah State University Department of Instructional Media was used in the Fault Tree Analysis phase of the study. The local panel members are listed in appendix B.

The research methodology employed in combination two recently developed tools, Fault Tree Analysis, which was first applied to the behavioral sciences by Kent Stephens,[17] and Delphi,[18] a tool developed out of a series of Rand Corporation studies.[19]

Delphi-Fault Tree Analysis (DEFT) will be discussed in detail in chapter three which deals with methods and procedures of this study.

HYPOTHESIS

It was hypothesized that:

1. There is no consensus of national experts as to what teachers should know and what they should be able to do in effectively using library media centers.

2. There is no consensus of national experts as to what library media center learning experiences teacher educators should provide

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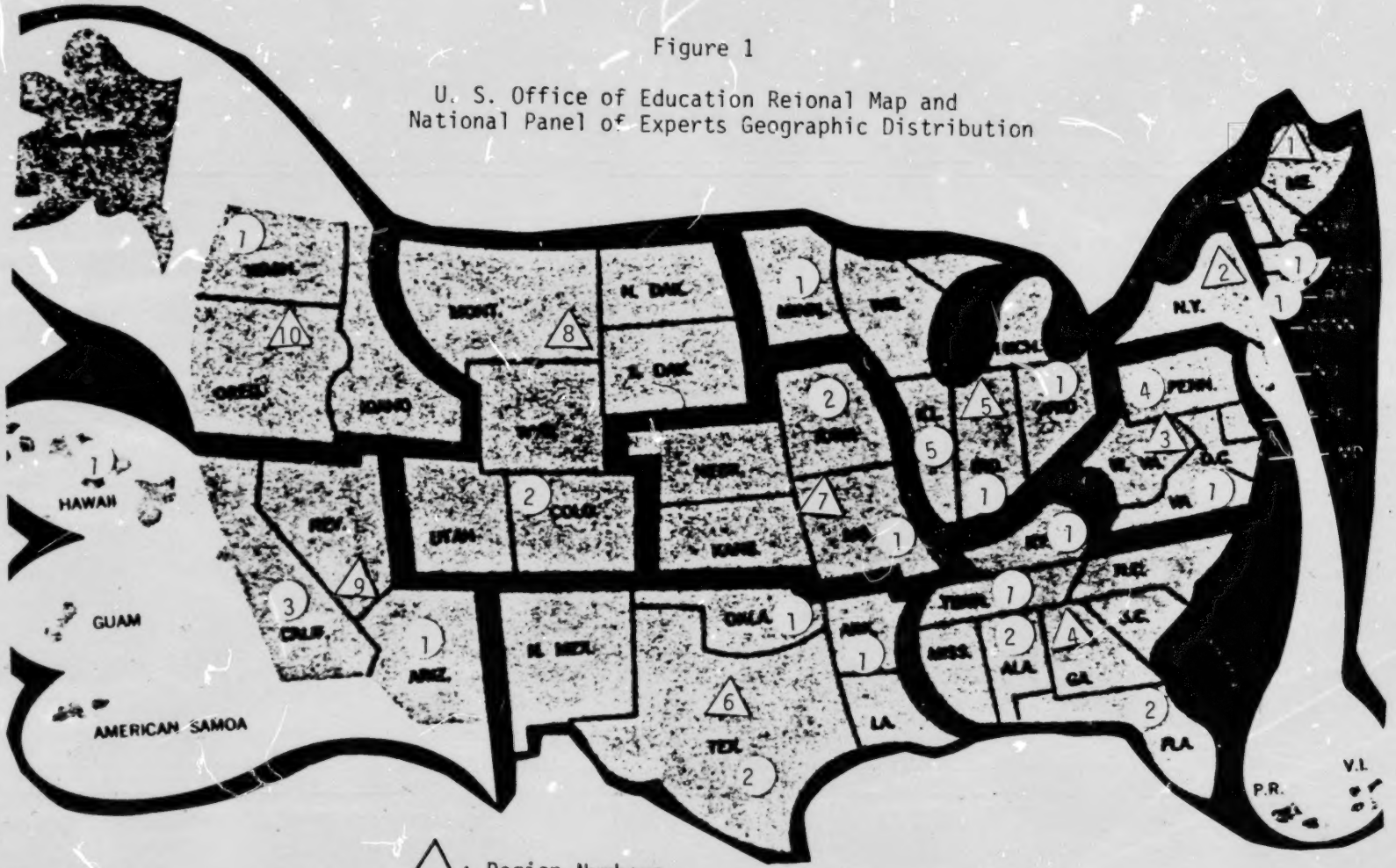
[17] Kent G. Stephens, "A Fault Tree Approach to Analysis of Educational Systems as Demonstrated in Vocational Education," (unpublished Doctoral dissertation, University of Washington, 1972).

[18] Joseph P. Martino, Technological Forecasting For Decionmaking (New York: American Elsevier, 1972), pp. 18-64.

[19] Olaf Helmer, Bernice Brown and Theodore Gordon, Social Technology (New York: Basic Books, 1966).

Figure 1

U. S. Office of Education Reional Map and
National Panel of Experts Geographic Distribution



△: Region Numbers

◯: Number of Experts From Regions By States

for future teachers.

3. There is no identifiable and specifiable needs for the improvement of teacher education programs in terms of teacher use of library media centers.

4. Methodology which will test possible consensus may be successfully applied to the described problem of this study.

5. Delphi-Fault Tree Analysis (DEFT) may serve effectively as a needs assessment tool in national instructional development projects.

6. DEFT may provide a more systematic means of projecting changing needs in American public and higher education in the future.

DEFINITION OF TERMS

In order to establish a common frame of reference, the following definitions of terms are given:

Library Media Center

The library media center (LMC) is a term used to include the traditional school library programs, sometimes identified as instructional media centers. The LMC is a learning center in a school where a full range of print and audiovisual media, necessary equipment, and services from media specialists are accessible to students and teachers.[20] The term library media center has been used in the literature for designating programs which combine library and audio-

---

[20]American Association of School Librarians and the Department of Audiovisual Instruction, Standards For School Media Programs (Chicago: American Library Association and Washington, D.C.: National Educational Association, 1969), p. xv.

visual services.[21]

Media

Media, often referred to as instructional media, is "printed and audiovisual forms of communication and their accompanying technology."[22]

Technology

The term "technology" comes from the Latin *texere* which means to weave or construct and does not necessarily imply using machines, as many educators are inclined to believe. The machines are dependent upon technique, and therefore represent only a fractional part of the context of technology. Technology refers to any practical art using scientific knowledge, and thus the use of machines in an instructional setting reflects the use of scientific knowledge.[23]

Educational Technology

Educational technology has been defined as:[24]

> The application of systematic processes for the design, implementation, and evaluation of the total process of learning and teaching in terms of specific objectives. Educational technology employs a combination of human and non-human resources to bring about more effective instruction.

---

[21]Emanuel and Joyce S. Prostane, The School Libray Media Center (Littleton, Colorado: Libraries Unlimited, 1972), pp. 20-21.

[22]American Association of School Librarians, loc. cit.

[23]Paul Saettler, "The Meaning of Instructional Technology," in his A History of Instructional Technology (New York: McGraw-Hill, 1968), pp. 1-7.

[24]National Special Media Institutes, Instructional Development Development Institute Glossary, [n.p.]: 1972 (unpaged).

Saettler discusses the development of instructional technology as both a behavioral science concept and a physical science concept. Although both are important, the concept emphasized in this study is the behavioral concept for both educational and instructional technology. The definition of instructional technology is complex and perhaps better understood by viewing the interrelationships of the physical and behavioral sciences depicted in the diagram on page 12.

Because of the tendency of some persons to use "educational technology" and "instructional technology" as synonyms, the following additional brief definitions are given to further clarify terms relating to the total educational program with special application to media processes:[25]

Educational Technology: The broad application of scientific processes to the solution of educational problems and the fulfillment of learners.

Instructional Technology: The formulation and selection of management systems for instructional development.

Instructional Development: The solution of instructional problems through design and application of instructional systems and their components.

Instructional Systems Components: All resources which can be designed, utilized, and combined in a systematic manner with the intent of achieving learning.

Instructional Systems: An integrated group of program components organized to accomplish stated objectives.

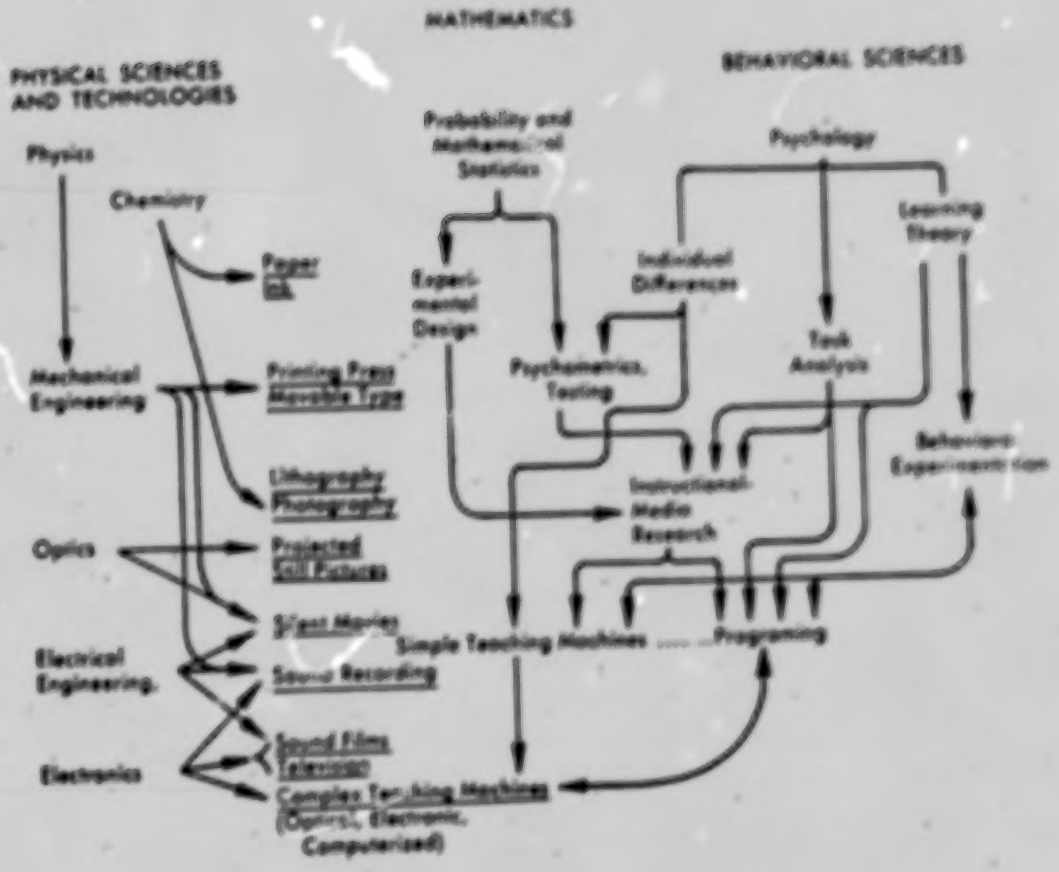
Instructional Product Design: The process of identifying or creating the most effective materials to meet the specific objectives of learning experiences.

---

[25]American Association of School Librarians and Association For Educational Communications and Technology, Media Programs: District and School (Chicago: American Library Association and Washington, D.C.: Association For Educational Communications and Technology, 1975), pp. 112-113.

Figure 2

Interrelationships in Physical and Behavioral Sciences
Related to Instructional Technology



Source:

E. R. Hilgard, ed., "Diagrammatic representation of the interrelationships in physical and behavioral sciences related to instructional technology." Theories of Learning and Instruction, The Sixty-Third Yearbook of the National Society for the Study of Education, Part I. (Chicago: The University of Chicago Press, 1964), p. 375.

Teacher Use of Library Media Centers

The "use of libraries" traditionally meant the knowledge and skills necessary to retrieve print information from tools such as the card catalog and periodical indexes.[26] Use of library media centers includes the traditional skills, plus those needed to retrieve information in non-print formats, such as filmstrips, tapes, films, transparencies, realia and other information structures from the LMCs as well as from publishers and producers for purposes of use in the teaching-learning process. In addition, new concepts are developing which are also part of using library media centers, such as learning resources development which includes production. That is to take the specifications developed in the designing of learning experiences and either locate needed resources or to create the necessary learning resources. The "use of library media centers" is a dynamic and enlarging process.

Delphi

Delphi is a technique or method of eliciting and refining group judgements. The rationale for the procedures is primarily the age-old adage "two heads are better than one," when the issue is one where exact knowledge is not available.

The Delphi technique has three main features:

1. Anonymous response, as opinions of members of an expert group are obtained by formal questionnaire.

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[26]George S. Bonn, "Training Laymen in the Use of the Library," in State of the Library Art, Vol. 2, Part I, edited by Ralph R. Shaw (New Brunswick, N. J.: Graduate School of Library Service, Rutgers, The State University, 1960), pp. 1-75, reviews the training in the "use of the library."

2. Iteration and controlled feed-back-interaction is effected by a systematic exercise conducted in several iterations with carefully controlled feedback between rounds.

3. Statistical group responses - the group opinion is defined as an appropriate aggregate of individual opinions on the final round.

The three features described above are designed to eliminate the biasing effects of dominant individuals, to lessen irrelevant communications, and to avoid the group pressure towards conformity which is a common effect of group interaction such as in traditional techniques as a "round table discussion" which may mold rather than discover group consensus.[27]

Fault Tree Analysis

Fault Tree Analysis is a technique for increasing the probability of success in any system by analyzing the most likely modes of failure that could occur. It is a graphic portrayal of a functional system utilizing a branching process analogous to the outline of a coniferous tree, with the undesired event located at the apex, and the other contributing failure events as branches sprouting from the undesired event and extending downward and outward. This method of analysis provides a logical, step by step description of the various combinations of possible occurrences within a system which can result in a predefined undesired event. Fault Tree Analysis may be used to analyze operating

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[27] Norman C. Dalkey, The Delphi Method: An Experimental Study of Group Opinion, Report RM-5888-PR (Santa Monica, California: Rand Corporation, June, 1969), p. v.

systems or planned systems.[28]

Needs Assessment

Needs assessment in instructional development is:[29]

> An activity in the Define Stage in which data is collected from individuals and groups involved in a particular educational situation to determine the nature of the problem and to determine how the groups involved value what exists (status quo), what should be (the ideal situation), and the need or difference between what is and what should be (e.g., looking at existing policies, analyzing job changes, gathering opinions from community or present programs to determine the needs.

Delphi-Fault Tree Analysis (DEFT)

The use of Delphi and Fault Tree Analysis in combination is identified and coined from the present study as DEFT Systems Analysis, shortened to DEFT. It provides for problem identification and analysis for systems failure and for systems success under a variety of conditions.

SUMMARY

In summary, the problem of formulating a national needs assessment as a first step in instructional development to clarify what teachers need in way of instruction and knowledge in using library media centers in the future has been introduced. The literature reveals that this has not been done even though statements expressing concern date back to 1776.

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[28]Bella Ruth Wilkin and Kent G. Stephens, Fault Tree Analysis: A Management Science Technique for Educational Planning and Evaluation (Hayward, California: Alameda County School Department, 1973), Technical Report Number 8, p. 3.

[29]National Special Media Institutes, loc. cit.

The use of library media centers is closely related to instructional technology and is an important resource for the teacher if used efficiently and effectively. Studies to date reveal a lack of skill on the part of teachers in using the LMC's but do not identify the depth of teacher needs in this area. The present study is undertaken to fill that void and to lay the foundation for future studies in instructional development for teacher use of library media centers.

A detailed review of the pertinent literature and related studies is reported in chapter two.

Chapter 2

REVIEW OF LITERATURE

The background of teacher use of library media centers is reviewed in this chapter. The contents include the periods of time for the (1) eighteenth century; (2) the nineteenth century; and then the (3) nineteen thirties, forties, fifties, sixties and (4) recent studies related to the problem. The problem of the study includes the analysis of required teacher skills and knowledge as determined by the review of literature and as suggested by the panel of national experts so as to give a basis for instructional development for teachers learning to utilize library media centers effectively as a prime tool with the teaching-learning process. The study is a needs assessment, that is a study to determine what exists (status quo) and what should be (the ideal situation).

Studies which are reviewed include historical background materials dating back to the American Revolution, 1776. This literature relates to use of the traditional library prior to its changed role as a library media center as earlier defined in chapter one. Delphi and Fault Tree Analysis methodologies were determined to be germane to the review but are treated in chapter three with methods and procedures.

No national study which used a systems approach to the problem of teacher use of library media centers was found. Therefore, this study is purported to be the first systematic national needs assessment designed to determine requirements of teachers in effectively using library media centers.

THE EIGHTEENTH CENTURY

About the time of the American Revolution, a British subject, educator and scholar, Dr. Samuel Johnson, was concerned about the use of libraries. He viewed using libraries as a *second kind of knowledge*. In a discussion recorded by his biographer, Boswell, he remarked:[1]

> . . . Sir, the reason is very plain. Knowledge is of two kinds. We know a subject ourselves, or we know where we can find information upon it. When we enquire [sic] into any subject, the first thing we have to do is to know what books have treated of it. This leads us to look at catalogues, and the backs of books in libraries.

It is this second kind of knowledge, that of knowing how to locate and retrieve information which is a concern of this study. For teachers who are concerned not alone with the teaching of current facts but also that of reasoning and problem solving, the second kind of knowledge becomes even more meaningful. Open schools, independent and individualized learning, flexible scheduling, methods of inquiry and discovery, are some of the modes of learning that lend emphasis to the needs of teachers in effectively using libary media centers. This need has been expressed for more than a century by a number of American educators.

THE NINETEENTH CENTURY

Henry Adams, an American scholar, was concerned with skills and knowledge which enabled youth to learn and suggested the teacher was failing the challenge. In his autobiography he stated:[2]

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[1]George Birkbeck Hill, ed., Boswell's Life of Johnson, Volume II, 1765-1776 (London: Clarendon Press, 1887), p. 365.

[2]Henry Adams, The Education of Henry Adams: An Autobiography (New York: Houghton, Mifflin, 1918), p. 314.

> . . . No doubt the world at large will always lag so far behind the active mind as to make soft cushion of inertia to drop upon, as it did for Henry Adams; but education should try to lessen the obstacles, diminish the friction, invigorate the energy, and should train minds to react, not at haphazard, but by choice, on the lines of force that attract their world. What one knows, in youth, of little moment; *they know enough who know how to learn.* Throughout human history the waste of mind has been appalling, and, as this story is meant to show, society has conspired to promote it. No doubt the teacher is the worst criminal, but the world stands behind him and drags the student from his course.

In 1880, an early plea was made for teachers to prepare to teach the use of reference books and libraries to elementary school children. The concern was expressed to the Elementary Department of the National Educational Association. After presenting a case of an elementary school graduate who failed to learn to use the library, Mary W. Hinman expressed: "Better that she should have come out with a more scanty knowledge of the facts themselves, but knowing how to find them easily."[3]

In 1887, a school principal, writing on the school and the library, stated that "If a library is to be really useful to a community, it is necessary that its readers should be specially trained for using it."[4]

At the 1892 NEA meeting, a librarian presented the following notion in a paper:

> . . . I assume that the varying and to some extent contradictory plans which are urged for this purpose have this in common--that they are disposed to free themselves from the exclussive use of text-books--text-books which are too often mere quiz-compends--and to study literature, history. and the natural sciences by a broader and more attractive method. This implies the use of books and

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[3]Mary W. Hinman, "The Practical Use of Reference Books," Addresses and Journal of Proceedings of the National Educational Association, Session of the year 1880, Chautauqua, New York, p. 195.

[4]Thomas J. Morgan, "The School and the Library," Journal of Proceedings and Addresses of the National Educational Association, Session of the Year, 1887, Chicago, Illinois, p. 192.

implies the library.[5]

Melvil Dewey presented a philisophical statement of why a library department should be formed in NEA in 1896.[6] The next year at the department meeting of the newly formed group, a paper suggesting more extensive training of teachers in the use of libraries was presented.[7] By 1898, articles on the subject of teacher use of libraries were beginning to appear in library journals. Adams wrote in the official journal of the American Libary Association that "before training in use of libraries and reference-books can form part of the school system it is evident that teachers must be prepared to give such instruction."[8]

Adams surveyed forty of the "formost normal schools" with a fifty percent response which indicated half of the schools were concerned with teaching the use of the library to prospective teachers.[9]

An 1898 NEA committee report suggested that there should be a careful examination of the relations existing between libaries and schools

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[5]W. H. Brett, "The School and the Library," Journal of Proceedings and Addresses of the National Educational Association, Session of the Year 1892, Saratoga Springs, New York, p. 692.

[6]Melvil Dewey, "The New Library Department of the National Educational Association, Statement of the Request made by Melvil Dewey as representing the Librarians before Executive Board at the Buffalo Meeting, July 7," The National Educational Association Journal of Proceedings of the Tirty-fifth Annual Meeting, Buffalo, New York, July 3-10, 1896, pp. 998-1003.

[7]Mae E. Schreiber, "The Training of Teachers so that They May Cooperate with Librarians," National Educational Association Proceedings and Addresses of the Thirty-sixth Meeting, Milwaukee, Wisconsin, July 6-9, 1897, pp. 1008-1014.

[8]Emma Louise Adams, "Instruction in the Use of Reference-Books and Libraries," Library Journal, XXIII (July, 1898), p. 84 of the appended Chautauqua Report.

[9]Ibid., p. 85.

and the question of how to encourage normal schools to give more instruction in the use of books and libraries was considered.[10] In the same NEA Proceedings, a paper entitled "The Use of the School Library,"[11] was presented by the Superintendent of Schools, Ishpeming, Michigan, followed by a librarian's paper on the "Connection Between Libraries and Schools."[12]

In 1899, reflections were made upon the two preceeding decades:

> I have at hand a little book (Libraries and Schools, by S. S. Green, published in New York by F. Leypoldt) compiled almost twenty years ago, composed of papers all twenty years old or more, in which are discussed, and well discussed, the identical questions that are at present occupying our attention. . . In every paper the same needs are set forth, the same methods are suggested, the same ideals are pictured, the same hopes are raised, that we are today listening to during these sessions of our department. This was twenty years ago; yet today, with certain notable exceptions, the school and the library have never yet been joined in that union which the lovers of both had so fondly hoped and so assiduously labored to bring about. . . .
>
> Our business just now is not with the librarian, but with the teacher; our highest aim for the present should be to awaken upon his part a livelier interest in and a deeper insight into this, one of the greatest of modern educational movements.[13]

A detailed description and outline of a "library use" course for teachers was given in 1898.[14] The course included various reference

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[10]"Report of the Committee on Relations of Public Libraries to Public Schools," The National Educational Association Journal of Proceed- and Addresses of the Thirty-seventh Annual Meeting, Washington, D.C., July 7-11, 1898, p. 1006.

[11]Richard Hardy, "The Use of the School Library," ibid., pp. 1007-1009.

[12]S. S. Green, "Connection Between Libraries and Schools," ibid., pp. 1009-1011.

[13]C. C. Young, "The Use of the Library," The National Educational Educational Association Journal of Proceedings and Addresses of the Thirty-eighth Annaul Meeting, Los Angeles, California, July 11-14, 1899, p. 1150.

[14]Irene Warren, "Instruction in Use of Books in a Normal School," Public Libraries, III (May, 1898), pp. 151-153.

sources including encyclopedias, dictionaries, and periodical indexes. The four aims [objectives] of the course were listed:[15]

1. To show the value of the library in educational work.
2. To show the way to use books to the best advantage.
3. To familiarize teachers with the best reference books, periodicals, and authors.
4. To acquaint teachers with the labor and time saving devices librarians have carefully work out.

The course was presented to approximately 280 students at the State Normal School, Stevens Point, Wisconsin. The course was one which used a problem approach. A sampling of some of the problmes worked with in the course included:[16]

1. Give the seven wonders of the world.
2. Where are the seals of the states given?
3. Where are the illustrations of various snowflakes to be found?
4. In what books are the following characters: Agnes Wickfield, Rosalind, Pospero, Old man of the seas?

Warren credited the encouragement to devise the Steven's Point State Normal Library Use Course for Teachers to the 1876 United States Government Report on Libraries, but specifically referred to a paper by B. F. Perkins included in that document. The Perkin's paper was reviewed for accuracy and for inspiration to the content on school libraries suggested by Warren. The particular passage referred to

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[15]Ibid., p. 152.

[16]Ibid.

with the first paragraph added to give context stated:[17]

> The new field, then is not actually occupied, in any complete way, though doubtless some hints pertaining to it are more or less subjoined to some of the above enumerated courses of instruction. What will the new chair teach?
>
> Not the history of literature, nor any one literature, nor any one department of literature, nor the grammar of any one language, nor language itself, nor any form of its use, nor even any particular form of thought. It is something higher than any of these; it is not any one subject, any one field of investigation, but it is a method for investigating any subject in the printed records of human thought. It might be compared with the calculus in applied mathematics; it is a means of following up swiftly and thoroughly the best researches in any direction and of then pushing them further; it seeks to give a last and highest training for enlarging any desired department of recorded human knowledge. It is the science and art of reading for a purpose; it is a calculus of applied literature.[18]

THE EARLY TWENTIETH CENTURY

During the first year of the twentieth century another reflection upon the professorship of use of books and libraries was again stated:[19]

> . . . The true democratic idea is that a professorship of books should be established in every schoolroom.
>
> But how shall the blind lead the blind? How shall the teacher who herself never has learned to know, to enjoy, and to choose good books guide others to do so?
>
> The library is a storehouse of great thought, an unfailing source of healthful recreation, but also the library is the mine in which the practical man and woman, the lawyer, the machinist, the scientist, the teacher, must dig deep for information, if he is to keep near the head of his own line of work.

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[17] Ibid.

[18] F B. Perkins, "On Professorships of Books and Reading," Public Libraries in the United States of America, Special Report, Department of Interior, Bureau of Education, Washington, D.C.: U.S. Government Printing Office, 1876 (Reprinted by University of Illinois Graduate School of Library Science, 1969), p. 231.

[19] May L. Prentice, "Vitalizing the Relation Between the Library and the School," Library Journal, XXVI (July, 1901), p. 79 of the appended Waukesha Conference Report.

> So far, as I have said before, nearly all organized effort to teach the teachers along these lines has come from the library. Certain normal school and college librarians have done much, but to a large extent the work has been on sufferance. Odds and ends of the students' time and attention have been given to it.
>
> The desirable thing is that the study of juvenile literature and the use of the library shall take equal rank with other studies in the preparation of prospective teachers; that the normal school, the pedagogical department of the college and university, the teachers' summer school and institute, shall recognize this subject in their curricula.
>
> The practical side of library use--its use for information--is easily seen by the public, and schools for teachers can quite readily be induced to make room for the course of study suggested.

Again in 1901, Warren reviewed the need for library use courses for teachers to be added to the normal school curriculum. She suggested that the teachers be instructed in the use of reference books, dictionaries, cyclopedias, handbooks, indexes and bibliographies, along with the present relation of libraries to schools. In addition, Warren suggested that teachers should be taught more about government documents and publications. She concluded that normal schools should "teach the students to be intelligent, economic users of books and libraries, and how in turn they may teach their pupils."[20]

Reflecting on the trend of the early 1900's to better utilize libraries in education, a school superintendent suggested that:

> The best teachers are coming to see that the text-book in the hands of the pupil is at the most merely a working guide or manual, rather than a compendium of information on the subject at hand.

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[20]Irene Warren, "What the Normal Schools Can Do For Teachers on the Library Side," National Educational Association Journal of Proceedings and Addresses of the Fortieth Annual Meeting, Detroit, Michigan, July 8-12, 1901, pp. 841-847.

They feel the need of access to fuller sources of information than the meager contents of text-books and schoolroom helps.[21]

"Library Instruction in the Normal School" was the title of a paper presented to the 1903 NEA meeting.[22] That article described formative coursework for teachers in using library resources, followed by a paper dealing with the same subject which stated:[23]

> Since a normal school is a school whose students are taught to be leaders of others in educational effort, it is a legitimate question for a normal school to ask what it can do in the matter of teaching library instruction. The normal school has a legitimate part in the work-a part that is distinctly its own, and in performing which it in no way infringes on the work of the regular library school. . .
>
> Those who are to become teachers should have instruction in what books there are in the world, how to get them, and how to use them. The normal school, training the teacher to go out to teach the coming generation, is the most economic place to have this instruction given, and, having the training schools in connection with them, the adaptation of the books and work to the children can be tested and adusted, at the least cost in time and effort. How long will it be until normal schools see the part that is theirs and do it as it should be done?

Articles on the subject of library instruction in the normal schools continued to call for courses to be developed and introduced through 1904 to 1906. One was penned by a President of a normal school,[24] another article authored by an Associate Superintendent of the New York

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[21] W. A. Millis, "The Library as an Educator," National Educational Association Journal of Proceedings and Addresses of the Forty-first Annual Meeting, Minneapolis, Minnesota, July 7-11, 1902, p. 802.

[22] William H. Brett, "Library Instruction in the Normal School," National Educational Association Journal of Proceedings and Addresses of the Forty-second Annual Meeting, Boston, Massachusetts, July 6-10, 1903, pp. 971-976.

[23] Mary Eileen Ahern, "Library Instruction in the Normal School," Ibid., pp. 976-980.

[24] Theodore B. Noss, "Library Work In Normal Schools," National Educational Association Journal of Proceedings and Addresses of the Forty-third Annual Meeting, St. Louis, Missouri, June 27-July 1, 1904, pp. 912-917.

City Schools,[25] a third by another President of a normal school, [26] with another by a librarian describing an emerging course at the State Normal School at Whitewater, Minnesota.[27] One public librarian developed a course offered to normal school students in Dayton, Ohio.[28] The Superintendent of Schools for Seattle, Washington asked the question, "Is there a need for instruction in library methods by the normal schools and universities?[29] He answered his question in the affirmative and described a survey of practicing teachers who supported the notion of a course in use of the library for teachers. One teacher, among several quotes listed, stated:[30]

> There is no doubt that a knowledge of library methods. . . is not only desirable in a teacher's equipment, but also almost necessary. Without it one wastes a lot of time in a strange library. One gradually acquires that knowledge from experience, but we would arrive at it more quickly is such a course were offered in college.
>
> Yes, pupils do not know how to use a library, hence we have to teach them, and we need to know.

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[25]Clarence E. Meleney, "The Place of the Library in School Instruction," Ibid., pp. 925.

[26]Jasper N. Wilkinson, "The Duty of the Normal School in Relation to District School Libraries," Ibid., pp. 919-923.

[27]Grace E. Salisbury, "Library Work in a State Normal School," Public Libraries, VIII (March, 1903), pp. 93-94.

[28]Linda M. Clatworthy, "A Library Course Given to City Normal School Students, Library Journal, XXXI (April, 1906), pp. 160-163.

[29]Frank B. Cooper, "Is There A Need for Instruction in Library Methods by Normal Schools and Universities?," Library Journal, XXXI (April, 1906), pp. 157-160.

[30]Ibid., p. 159.

In Wisconsin, a special Institute of Normal School Librarians was held at Oshkosh, December 21, 1906. Several topics were considered and resolutions formally presented and voted upon. For the "coming teacher" the group stated that they [as part of the normal school faculty] do these distinct things:[31]

1. Help him to foster a professional spirit.

2. Train him for utilizing his school and other libraries, that he may lead his pupils to use and enjoy good books.

3. . . . assist the future teachers of the state that they may appreciate the value of a library, be familiar with the best reference books and periodicals, and know how to use school libraries to some advantage.

The Wisconsin Library Institute of 1906 also passed resolutions:

1. Believing that the various reference lists and syllabi which have been compiled by the teachers or librarian of any one of the normal schools would be of material benefit to librarian, teachers, and students of each of the sister schools, we most earnestly recommend that a strong effort be made to secure all such lists and syllabi that they may be printed and distributed among the schools.

2. As a course in library methods is necessary to the complete equipment of the trained teacher, and as the present course of study allows the librarian no time in which to give that instruction, therefore we earnestly request that such instruction be made a part of the school course, and a requirement for graduation.

In the same journal, the librarian of the Milwaukee Normal School published a description of a course for teachers using libraries.[32]

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[31]Lizzie P. Swan, "Institute of Normal School Librarians," Public Libraries, VI (February, 1906), pp. 92-93.

[32]Anne H. McNeil, "What the Normal School May Do To Provide for Library Work in Schools," Public Libraries, VI (February, 1906) pp. 80-81.

It was suggested in that article that:

> Our teachers can do nothing for a child which will be of more value to him in after life than to train him in such a manner that he will leave school with a knowledge of how to use books and a desire for good books. Children should be made so familiar with the use of the library that it will become an actual need to them in their future studies, and great pains should be taken to show them the use of catalogs, indexes, and all sorts of reference books. They will soon become familiar with them and handle them as well as older students.
>
> In order to so train the children, our teachers must first be trained, and there is no better opportunity for teaching the use of books than in a normal school. . .
>
> The following is a short outline of the work which will be most valuable on reference books:
>
> 1. A short history of the book--how made, its binding and care. A visit to some bindery should be made while studying this topic.
> 2. Aids in the selection of books.
> 3. Encyclopedias, general and special characteristics: Time, scope, maps, illustrations, portraits, special features; strong and weak points, including whether strong in history, biography, geography, politics, sciences, and fine arts.
> 4. Dictionaries: Scheme of criticism, spelling, pronunciation, definitions, special features. Compare differences as to quality and scope.
> 5. Handbooks of general information. Important things to know of these is index.
> 6. Atlases and gazetteers: Important points--accuracy, scale, quantity and quality of matter, engraving.
> 7. Indexes to periodical literature.
> 8. Other indexes and theory of indexing.
> 9. Bibliographies.
> 10. Almanacs and other statistical manuals, as Statesman's yearbook.[23]

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[23]Anne M. McNeil, Ibid., p. 81.

It is of interest to note the completeness of the topics concerning reference tools. Not a great deal has been added to reference courses for teachers since that list excepting the bibliographic and indexing tools for the newer media, such as guides and indexes for filmstrips, films, tapes and programmed instruction, among the several.

The year 1938 was also an important date in instruction in use of libraries in normal schools, as the American Library Association and the National Education Association printed a special report and distributed it widely. The report was in form of a manual of study which occupied seventy-one pages of outlines and syllabus materials focused on library methods to be taught in normal schools. The report was a landmark event which had come about due to the resolution which was passed at the St. Louis meeting of June 30, 1938.[38]

The 1938 Report, when delivered to the NEA, was discussed by the Assistant Superintendent of City Schools, Los Angeles, California. He was complimentary of the report as a document of the best library practice and suggested that a copy should be in the hands of every normal school librarian, and also in the hands of every actual and prospective teacher.

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[38] National Education Association Report on Instruction in Library Administration in Normal Schools, prepared by Elizabeth E. Baldwin and submitted to the National Council of Education by a Committee on Cooperation Between Public Schools and Public Libraries in Accordance with the Recommendations of the National Council and the Authorization of the Board of Directors at its Meeting in Asbury Park, New Jersey, July 6, 1938 (Winona, Minnesota: National Education Association, May, 1938). 71 pp. The letter of transmittal to the National Council of Education, titled the document Report of the Joint Committee, Representing the American Library Association and the National Educational Association on Instruction in Library Administration in Normal Schools, with the Chairman, James M. Canfield, signing along with Mabel Ivory, Mary E. Storm, Electra C. Doren and Martin Hensel, with the letter dated January, 1938.

Superintendent Dunbar of the Los Angeles Schools was generally critical of the outline as a course of study for library use and specifically critical of the lack of enough attention being directed to children's literature. He ended his discussion at the presentation of the report stating:[35]

> I would further urge, in line with the objective, as expressed by the president of the council, that steps be taken by this body to secure a report, made with the same care as the one under consideration, on a course in children's literature for normal schools.

During the 1957 ACE meeting, another paper was presented by the "Critic Teacher" of the State Normal School, Los Angeles, California. She suggested that:[36]

> The question for our consideration is--is there need for instruction of prospective teachers in the contents and use of libraries, whereby student energy may be directed? The testimony of librarians and county superintendents is valuable to us here. The experience of these two classes of public officials leaves us no doubt as to the general need for instruction in the contents and use of libraries. The inability of even these classes of students to use a library economically is indication enough of the need to direct and systematize instruction in library method.

After a brief discussion, the "Critic Teacher" Sullivan ended with:[37]

> This cursory treatment of the necessity for and the materials of instruction of all prospective teachers in the uses and contents of libraries with a view to directing student energy to be considered is merely suggestive. My task was to add one more word to what has been said before on the necessity for library instruction. The systematic working-out of the material for instruction is reasonably left to those who will be associated to do this important work.

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[35] Irving F. Dunbar, "A discussion of the Report of the Committee on Instruction in Library Use," Section on Normal Schools, California Education Association Journal of Proceedings and Addresses of the Fifty-Fifth Annual Meeting, Los Angeles, California, July 9-12, 1957, pp. 353-355.

[36] Elizabeth F. Sullivan, "Instruction of All Prospective Teachers in the Contents and Use of Libraries," ACE Proceedings, 1958, p. 357.

[37] Ibid., 357.

Mary E. Ahern, in an editorial that appeared in 1909 reported some progress with normal schools and condemned others:[38]

> Some normal schools are beginning to realize the importance of of knowledge of books as tools as well as means of culture and are providing means for making good the lack of such knowledge. In time those who are trained in these schools may pass on their knowledge, but at present high schools generally are sadly derelict in this regard. Here and there, one and another are beginning to realize their neglect of the important study of books and are moving toward better things, but the problem as a whole is in a sad state of neglect.

Another authority, Louis Round Wilson, stated in 1912 that normal schools are responsible for preparing teachers in the use of libraries and reflected back upon the NEA Report of 1906:[39]

> After the libraries have been secured and proper methods of administration of the system have been devised, provision should be made for the training of teachers in the use of books and children's literature. . . . It is the clear duty of the departments special normal schools, and of the conductors of summer schools and teachers' institutes to give this instruction. If we wish guidance in this matter, there are a dozen splendid manuals which can be had at a nominal price, and the extensive report of the National Education Association, submitted, adopted, and printed in 1906, are at hand.

The Superintendent of the Reading Room, Library of Congress, wrote what has become a classic in use of library literature, "Training in the Use of Books," which first appeared in the Sewanee Review for July, 1912, and was later reprinted in numerous copies as a separate document. Although not specifically directed to the "training of teachers," it draws conclusions to the importance of that training by suggesting the role of teaching students to use libraries effectively

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[38] Mary E. Ahern, "The Measure of Ability," Public Libraries, XIV (April, 1909), p. 129.

[39] Louis Round Wilson, "A Constructive Library Platform for Southern Schools," Library Journal, XXXVII (April, 1912), p. 183.

belongs in large part to teachers.[40]

An important reference work for educators published in 1913 reviewed sketchily the library training in normal schools. In that report, it was noted that the 1906 NEA document for preparation of teachers in library use was out of print. It was also reported that a number of state normal schools had given courses in library economy [science] in connection with their summer schools, and in Michigan instruction in library work had been given at teachers' institutes.[41]

First school library standards. By 1920, the first school library standards were published. Although not directly involved with teacher training, the document served to show the growing importance of secondary school libraries was growing nationally. Elementary school library standards were published by a joint committee of the American Library Association and the National Education Association in 1925. These standards were first published in the Fourth Year Book of the Department of Elementary Principals, and later as a separate document, and were actually more extensive than the earlier published standards for high schools. This document also attested to the growing importance given school libraries. Although not directly concerned with the training of teachers, this publication did have guidelines for teachers' work in preparing students

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[40]William Warner Bishop, Training in the Use of Books, Sewanee, Tennessee: University Press at University of the South, 1912, 19 pp. Comments especially on teachers and students is on p. 10.

[41]W. D. Johnston, "Library Training in Normal Schools," in Cyclopedia of Education, edited by Paul Monroe, Vol. IV, New York: Macmillan, 1913, p. 17.

to use libraries. Both of the first U. S. school library standards were produced by committees under the chairmanship of an english teacher, C. C. Certain.[42,43]

THE NINETEEN THIRTIES

The 1930's also produced more concern for teachers being prepared to use libraries. One paper was delivered to the American Library Association in 1934 by a special consultant at Teacher Colege Library, Columbia University. The suggestions were that teachers must be better instructed in use of libraries:[44]

> If the teacher-librarian relationship suggested here is to become possible it means two things: The teachers must be masters of the reference tools and literature of their own subjects, and the librarian must become acquainted with the courses of study and methods of instruction in her school. It therefore follows that a great deal of training that librarians receive in library school could well be used by teachers and certainly some of the methods used in the teaching profession would be an asset to the school librarian. There has been a gradual breakdown of the line separating the various subjects in the modern school. There is still need for removal of some of the imaginary lines between the work of librarian and teacher.

By 1936, a rather detailed series of articles began to appear dealing with teacher use of libraries. The Director of the Library

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[42] C. C. Certain, Chairman, Report of the Committee on Library Organization and Equipment, National Education Association, Department of Secondary Education, 1920, 30 pp.

[43] C. C. Certain, Committee Chairman, Elementary School Library Standards, prepared under the supervision of a joint committee of the National Education Association and the American Library Association, Chicago: The American Library Association, 1925, 36 pp. Pages 4-5 deal with teaching the use of the library.

[44] Ethel M. Feagley, "The Teacher and the Library: Possibilities and Responsibilities," American Library Association Bulletin, XXVIII (March, 1934), p. 123.

School at George Peabody College for Teachers stated that:[45]

> Recent trends in American education reveal an increasing library participation in the learning process. From kindergarten through graduate school there is tangible evidence that books and reading seem destined for a part heretofore contemplated only by idealists and a few educational leaders still in the vanguard. The often quoted Carlyle statement, "The true university is a collection of books," apparently is on the verge of realization in the American school system.

Louis Shores was one of the first to see the change that was coming. He related the development of the library as an integral part of the university and liberal arts college curriculum development, and the carry over to the public school system. Special note was made of Rollins' College "Professor of Books;" Swarthmore's "Reading for Honors Program;" Antioch's "Autonomous Courses;" and the "Idependent Study Program" at Chicago, Harvard, Princeton, Wabash and Southwestern. He noted that basically, each of the college plans decreased classroom attendance and increased libary use. Shores also related changes appearing in the public schools with their libary programs:[46]

> The last few years have brought an unprecedented increase in shool libraries. As long as the single-textbook teacher dominated the school program the library lagged. Largely through the efforts of librarians and progressive teachers library standards have developed and school collections have increased.

Shores pinpointed a major problem in his view:[47]

> The chief obstacle to school library development, however, has been the inadequate prepartion of the teacher and school administrator whose professional training has often suffered from lack of contact with adequate library resources.

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[45] Louis Shores, "Library Instruction for Teachers," Peabody Journal of Education, XIV (July, 1936), p. 128.

[46] Ibid., p. 129.

[47] Ibid.

Mabel Harris studied the status of library instruction in over one hundred teacher-training institutions, and on the basis of the study suggested a minimal program for teachers in training.[48] The following year the American Association of Teacher Colleges and the American Library Association appointed a joint committee to study the problem which issued a report one year later.[49] The 1930's was an active decade for attention being focused upon teacher use of libraries.

THE NINETEEN FORTIES

By 1940, a professor of English Education and also editor of Education Method, a prestigious journal of the time, suggested that librarians needed more backgroud as teachers and that the teachers must become better prepared in the use of the library.[50] Another statement appeared in Phi Delta Kappan the same year and suggested that teachers were over-trained in methods and undertrained in materials. It was further suggested in the article that teachers must learn effective use of the library to be able to provide "catering to individual differences," and that a course of study in the use of the library was badly needed by teachers and administrators.[51] Another article appearing in the same

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[48]Mabel Harris, "Non-professional Library Instruction in Teachers Colleges," Peabody Journal of Education, XII (September, 1934), pp. 86-95.

[49]American Association of Teachers Colleges and the American Library Association, Joint Committee, How Shall We Educate Teachers and Librarians for Library Service in the School? (New York: Columbia University, 1936), 74 pp.

[50]Lou LaBrant, "Library Teacher or Classroom Teacher?" Phi Delta Kappan, XXII (January, 1940), pp. 289-291.

[51]Louis Shores, "Library-Trained Teachers," Phi Delta Kappan, XXII (January, 1940), pp. 303-306.

journal devoted study to what every teacher should know about libraries.[52]

An extensive article on the preparation of teachers in use of libraries appeared in 1942. In that article, two library educators suggested the use of "materials centers" and the inclusion of all forms of communications be housed there. The crux of the statement was that teachers must learn more effective use of library media centers:[53]

> With the increased understanding of the nature, use and accessibility of materials of communication, . . . teachers in the school can make more purposive the instructional program of the school, and they can teach more effectively the students to be intelligent and interested consumers of print and non-print materials.

The Yearbook of the National Society for the Study of Education contained an article the next year on the need for teachers being prepared in library media use.[54]

The years of World War II brought a close to many things, and nothing of significance appeared on the use of teacher use of library media centers in the literature until 1948. That year two articles were published which focused on teachers and libraries.[55,56] Both authors called for courses for teachers in the use of library media centers.

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[52]Carter Alexander, "What Every Teacher Should Know," Phi Delta Kappan, XXII (January, 1940), pp. 292-295.

[53]Francis Henne and Mildred Hawksworth Lowell, "The Preparation of Secondary-School Teachers in the Use of Library Materials," Library Quarterly, XII (July, 1942), pp. 533-556.

[54]Ethel Feagley, "Teachers," The Library in General Education: Forty-second Yearbook of the National Society for the Study of Education, Part II, 1943, pp. 301-311.

[55]John Herrold Lancaster, "Teachers and Libraries," College and Research Libraries, IX (July, 1948), pp. 211-214.

[56]Walfred Erickson, "Library Orientation Programs for American Teachers Colleges," Wilson Library Bulletin, XXVII (July, 1949), pp.62-65.

An article published at the close of the decade of the 1940's reported a study on teacher use of school libraries emphasizing experiences be given in pre-service training, suggesting the void was extreme in teacher education.[57]

THE NINETEEN FIFTIES

An early editorial of the 1950's appeared in the Elementary School Journal suggesting further need for teachers to be prepared in the use of books and libraries:[58]

> If the children in our country are to be introduced to a wide variety of books and motivated to read them, it is essential not only to have library resources but also to have teachers who know these resources. . . Unless, however, the prospective teacher has had some introduction in his teacher-training program to a wide variety of books available for children, a long appenticeship awaits him. . . . That prospective teachers for elementary schools can be graduated with little or no knowledge about books for children seems fantastic but, nevertheless, remains true in many cases. This hiatus in the education of some teachers can be compared to a similar one in education of school librarians who are graduated from library schools with little or no preparation in the fields of curriculum, reading, child psychology and related subjects.

A children's librarian at a teachers college expressed a need for teachers to be more knowledgeable in the use of books and libraries based upon her experiences.[59]

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[57]Margaret White Boutelle, "A Study of the Use of School Libraries by Student Teachers," Peabody Journal of Education, XXVII (July, 1949), pp. 25-33.

[58]"Educational News and Editorial Comment," Elementary School Journal, L (March, 1950), pp. 368-369.

[59]Beulah Ann Counts, "Does Present Preservice Training Prepare Elementary School Teachers to be Book and Library Users?" Wilson Library Bulletin, XXV (May, 1951), pp. 668-672.

A statement appeared in the National Elementary Principal and was devoted to the problem of lack of preparation of teachers in use of library media centers.[60] Another statement was published in the Journal of Teacher Education suggesting a critical need for teachers to receive library education in their training.[61] One article suggested the need for courses specifically designed for preparing teachers in the use of library media centers.[62] Another writer focused upon the relationship of teachers teaching the use of the library to their students as necessitating more teacher preparation in library media center utilization.[63] A school library media specialist and a language arts teacher, both then at the now defunct Brigham Young University High School, were joint authors of an article suggesting the need for teachers to integrate library instruction with regular classroom instruction. They also suggested the need for teachers to be better prepared in the use of library media centers.[64]

It is of interest to note that in spite of the many ideas reflected in the review of the literature to this point, little attention was given to the need for *research* to ascertain what skills, knowledge or attitudes were important to be developed with teachers.

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[60]Janet Ellis Smith, "Training Teachers to Use Libraries," National Elementary Principal, XXXI (September, 1951), pp. 98-101.

[61]Ethel Garber, "Teachers Need Library Education," Journal of Teacher Education, V (December, 1954), pp. 318-320.

[62]Joseph F. Shubert, "Do Library Courses Meet Teachers' Need?" Library Journal, LXXXII (April 15, 1957), pp. 9-10.

[63]Dorothy Roche, "The School Library: Each Teacher's Responsibility," Wilson Library Bulletin, XXXI (April, 1957), pp. 630-631.

[64]June Berry and Winston Mercer, "Developing Library Skills--Every Teacher's Responsibility," Education, LXXVIII (October, 1957), pp. 78-81.

In fact, little agreement is found as to what was needed specifically as a curriculum in preparing teachers to effectively use library media centers in American public education.

THE NINETEEN SIXTIES

A thorough review of the literature relating to instruction in use of libraries was done by Bonn in 1960. He analyzed some 1100 citations to materials published from 1876 to 1960. He stated that more research was needed "on what teachers really need to know in order properly to use it [the library] themselves, to stimulate pupils to use it, and to teach pupils to use it." Shores published a related book.[65]

An important volume was published in 1961, based upon a doctoral dissertation, and stated:[66]

> Teachers and librarians may be expected to work closely together in specific areas of the library program, such as selecting the book collection or programs for classroom visits to the library, as well as in curriculum development, through committees, inservice training, bibliographies for units of study and presentation of new materials. . . . Teacher participation in the library during classroom visits is very important. . . . The attitude of the teacher toward the library has a direct bearing on the children's attitude and use of library facilities.

A review of more than 121 items which dealt with use of the library was made by another researcher, Henne. Active in school library develeopment, she was the chief writer of the 1969 School Media Standards. In her conclusions of her review of literature, she suggested more research concerning the design or structure of library instruction.

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[65]George S. Bonn, "Training Laymen in the Use of the Library," op. cit., pp. 63-64. Louis Shores, Instructional Materials: An Introduction for Teachers (New York: Ronald Press, 1960).

[66]Jean Elizabeth Lowrie, Elementary School Libraries (New York: Scarecrow Press, 1961). A second edition was published in 1970.

Henne stated:[67]

> Thus, one of the strongest recommendations made in this paper regarding research in library instruction involves inquiry, speculation, and contemplation rather than quantitative or systematic research. In many ways it is the most important recommendation proposed, because it is the most basic. All other proposals depend in large measure on what the judgements of the philosophers and experts might be. From them would come the basic and sound decisions, geared to the psychology of the process of learning, concerning the design or structure of library instruction: what, where, for whom, and how taught.

The statement by Henne which separated systematic research from use of expert opinion was prior to the release of a methodology to systematically solicit expert opinion and analyze the findings in a systematic way. The Delphi and Fault Tree Analysis methodologies are discussed in chapter 3 and now provide a means to carry out this aspect of the suggested research in teacher use of library media centers.

Three research monographs and three recent doctoral dissertations have treated aspects of teacher use of library media centers. Snyder[68] discusses a special seminar library project in an inter-university program in teacher education, stressing the need for teachers to be made more knowledgeable in using library media centers. Perkins reported a study of some 4,170 prospective teachers' knowledge of library fundamentals, as shown by their scores on standardized library tests.

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[67] Francis Henne, "Instruction in the Use of the Library and Library Use by Students," Conference on the Use of Printed and Audio-Visual Materials for Instructional Purposes, prepared by Maurice F. Tauber and Irlene Roemer Stephens with assistance of D. Marie Grieco and Richard J. Hyman, (New York: Columbia University School of Library Service, 1968), p. 175.

[68] Luella Snyder, The Second Kind of Knowledge: A Special Library Project Report to the Coordinator and Directors of Project I of the Inter-University Program in Teacher Education on the Use of Library Resources by University Students (Syracuse, New York: Inter-University Program in Teacher Education and School of Library Science, Syracuse University, 1964).

Perrin's sample was drawn from sixty-nine colleges and universities located in thirty-eight states.[69] His findings revealed that "the respondents [prospective teachers] are not capable of using library materials adequately, and their knowledge of the available resources is limited."[70] A third monograph was produced by the National Education Association's Research Division revealed that 1,457 of the 1,460 secondary teachers responding to a questionnaire believed training in using library media centers was important. They further believed that as teachers that they had a direct responsibility to make this training a basic part of the education of their students (by a count of 3 out of 4 teachers). Seventy-five percent stated that their professional preparation in the area of library resources and use was either non-existant or inadequate.[71]

RECENT STUDIES RELATED TO THE PROBLEM

Three studies of special importance in the area of teacher use of library media centers include Hagrasy,[72] Ducat,[73] and Swarthout.[74] Hagrasy established a positive relationship between the teachers' background in library skill and reading and their students' achievements in these areas at the sixth grade level. Ducat revealed secondary teachers

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[69]Ralph Perkins, The Prospective Teacher's Knowledge of Library Fundamentals (New York: Scarecrow Press, 1965).

[70]Ibid., pp. 198-199.

[71]National Education Association, Research Division, The Secondary-School Teacher and Library Services (Washington, D.C.: NEA, 1960).

[72]Seed M. El-Hagrasy, op. cit.

[73]Sister Mary Peter Claver Ducat, op. cit.

[74]Charlene R. Swarthout, op. cit.

in her study believed their preparation concerning library media centers to be inadequate. These same teachers rated the library media center as being of utmost importance for achieving teaching objectives in English, religion and social studies, and of considerable importance in science and home economics, and some importance in other fields of study. Swarthout revealed a general need for better preparation of teachers in the use of the school library media center and suggested an inservice program to fill the void in the professional preparation of teachers. These three studies, mentioned earlier in chapter one, all suggest a strong need for the improvement of teacher education in the use of library media centers.

Another recent dissertation involved a study of how teachers perceive availability and use media in relation to the learning act for handicapped students, and how teachers perceive media in relation to the teaching act in special education classrooms. The major finding was that teachers in all areas of special education used media when it was available.[75] It would seem that teachers who are prepared to locate and retrieve materials readily from the library media centers, or locate learning materials from commercial sources, both the traditional and the newer media, would also use media more frequently and with greater effectiveness. The most recent monograph published in teacher use of library media centers suggests local surveys and needs assessments as a key to successful library media center in-service programs.[76]

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[75]Rhoda R. Freeman, "Special Education Teachers' Perception in Regard to Use and Availability of Media, Los Angeles Unified School District," (unpublished Doctoral dissertation, Brigham Young University, 1973).

[76]Nancy Polletta, In-Service: School Library/Media Workshops and Conferences (Metuchen, N. J.: Scarecrow Press, 1973), p. 7.

SUMMARY

Statements in the literature dealing with the use of library resources for educational purposes date back to U. S. Colonial times. As early as 1880, direct reference is made to the need for teachers to be knowledgeable in the use of library media centers, as these centers were defined in chapter I. There is little evidence of what specifics should be included in this knowledge for teachers but numerous statements of a general nature are indicative of the concern for teachers to gain such a knowledge. Prior to the late 1950's few studies exist which apply research methodologies to the problem of teacher use of library media centers. There is a growing interest in the subject as revealed by the review of literature and suggestions for more scientific application of research methodology appear during the decade of the 1960's. A systematic national needs assessment appeared to be a logical step to follow.

Chapter 3

METHODS AND PROCEDURES

The purpose of this chapter is to describe the methods and procedures used in the study. The chapter contains:

1. A description of the Delphi procedures.
2. Selected studies employing the Delphi procedures.
3. The use of Lawe's Measure of Critical Consensus.
4. An explanation of Fault Tree Analysis.
5. The procedures used in selecting the national panel of experts.
6. The development of the instruments.
7. Funding of the NETA project.

DELPHI PROCEDURES

Educators, business executives, and managers of all types are faced with a multitude of decisions to be made. Many of these decisions are relatively unimportant, meriting only a quick consideration and analysis, while others are of prime importance. In matters of policy, budgeting, innovation, and goals, where does the decision-maker obtain the inputs that affect his judgments?

Many sources may be considered. First of all the administrator will probably research any studies that have been done on the topic area which he is concerned, if he can locate studies which exist. This is important, because such studies will likely cite or refer to useful documents, statistics, as well as carefully supported expert opinion. Another approach the administrator might take is to consult immediately

available experts through correspondence, group consultation, or individual interviews. Finally, he will often seek the opinion of lay people. Analyzing the available data and sources, he will then make his judgment on a particular matter of importance.

But what does a decision-maker do when he must make a judgment regarding a task or goal in an area where insufficient, if any, research has been done? Upon what information can he base his decision? He is left with current outside expert and/or lay opinion from which to base his judgment for decision making.

Obviously, the administrator should seek more than a single opinion. A single source would not give the decision-maker sufficient data to base an important decision. Subsequently, it would seem that several sources or experts should be consulted, and for the most efficiency, to be consulted in a systematic way. It would also be helpful if somehow these people providing the expert opinions and inputs could come to a consensus, or that a consensus could be "built" in some way, and thereby in many respects treated in a similar way to input from current studies.

One of the greatest difficulties with such a situation is to allow the experts the means of arriving at a consensus which have reflected upon the opinions of each individual, allowing each to consider and reconsider his contribution in light of the other experts' opinions. Such a consensus cannot be gained by separately asking each expert to give hs opinion and advice. This direct method does not allow for reconsideration through a system of feedback.

Another means which would seem a natural approach to soliciting expert opinion would be to hold a conference or committee meeting in an

attempt to arrive at or discover a consensus. The drawbacks for such an approach, when analyzed suggest the following:

1. The most dominant individual will likely influence, if not fully determine the final decision.
2. Extraneous material may be introduced which hinders the progress of the group toward consensus.
3. Group pressure pushes toward compromise before all else, and what is gained by this process may not be a consensus, but a compromise made on the basis of pressure rather than an input of data or information with reasons analyzed in detail.

There is an available procedure that provides an effective method of arriving at group consensus. The Delphi procedure or methodology was conceived and developed by the Rand Corporation for governmental use and was classified by the government as "top secret" for a number of years. It was originally designed to formulate foreign policy regarding Red China. The procedure has now been available for public use for sometime and has been utilized in a variety of settings and purposes, from business, education and government.

An early monograph titled Social Technology was one of the first to deal with the Delphi Method.[1] It reviewed the early procedures used in the development of the method and includes an appendix which gives a full example of instruments and their use.[2] In the same year of the Helmer publication, another Rand report was issued which applied the

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[1]Olaf Helmer, Social Technology (New York: Basic Books, 1966).

[2]Ibid., pp. 44-96.

Delphi Method to problems of educational innovation.[3] The second Helmer authored publication reviews the Delphi Method in direct language:

> The so-called Delphi Technique is a method for the systematic solicitation and collation of expert opinions. It is applicable whenever policies and plans have to be based on informed judgment, and thus to some extent to virtually any decision-making process.
>
> Instead of using the traditional approach toward achieving a consensus through open discussion, the Delphi Technique, in its simplest form, eliminates committee activity altogether, thus reducing the influence of certain psychological factors, such as specious persuasion, the unwillingness to abandon publicly expressed opinions, and the bandwagon effect of majority opinion. This technique replaces direct debate by a carefully designed program of sequential individual interrogation (best conducted by questionnaires) interspersed with information and opinion feedback derived by computed consensus from the earlier parts of the program. Some of the questions directed to the respondents may, for instance, inquire into the "reasons" for previously expressed opinions, and a collection of such reasons may then be presented to each respondent in the group, together with an invitation to reconsider and possibly revise his earlier estimates. Both the inquiry into the reasons and subsequent feedback of the reasons adduced by others may serve to stimulate the experts into taking into due account considerations they might through inadvertence have neglected, and to give due weight to factors they were inclined to dismiss as unimportant on first thought.[4]

The Delphi Method has been used in a number of doctoral studies, but the first was completed by Robert M. Campbell who used the technque for a study of forecasting business and economic indicies.[5] He conducted an experiment using students in two graduate seminars. Each seminar was divided into two groups which were given guidance in developing their

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[3]Olaf Helmer, The Use of the Delphi Technique in Problems of of Educational Innovation (Santa Monica, California: Rand Corporation, 1966)

[4]Ibid., pp. 1-2.

[5]Robert M. Campbell, "A Methodological Study of Expert Utilization in Business Forecasting" (unpublished Doctoral dissertation, University of California, Los Angeles, 1966).

expertise prior to the experiment. One group in each seminar used the traditional means of business forecasting and one group in each seminar use the Delphi Method for forecasting. The Delphi experimental groups gave individual responses to four questionnaires over a period of six weeks. These Delphi groups made more accurate forecasts than those using traditional means.

Delphi methodology for the first step involves the selection of a group of experts. The expertise might be determined by status among peers, by years of professional experience, by the experts own self-appraisal of relative competence in the area of inquiry, by the amount of relevant information to which (s)he has access or by some combination of objective indicies and *a priori* judgment factors.[6]

The individual "interviews" performed by the questionnaires administered are based upon the following:[7]

1. Each expert contributes at each step of the questionnaire process before seeing the inputs of other participants for that step.

2. While the individual expert knows his own responses throughout the process, input of others remains anonymous, and

3. Input gained at one step of the process is shared as part of the next step. Put another way, the Delphi Method is characterized by: 1) anonymity, 2) controled feedback and 3) statistical "group response."

As noted, Delphi methodology consists of three or four phases.

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[6]Bernice B. Brown, Delphi Process: A Methodology Used for the Elicitation of Opinions of Experts (Santa Monica, California: Rand Corporation, September, 1968), p. 4.

[7]Norman C. Dalkey, Delphi (Santa Monica, California: Rand Corporation, October, 1967), pp. 2-3.

each based upon questionnaire interviews. During phase one, the decision-maker solicits initial input from the experts he has chosen for this purpose. The first questionnaire might consist of a statement of the problem or goal the decision-maker wishes to deal with. In this phase the experts are asked to provide statements of their opinions. For example, if a school district decided to revamp its program, it would ask the experts to state the things they thought the district should achieve, maintain, or decrease, and the objectives students should accomplish. The completed, rather open-ended questionaire is then returned to the decision-maker. This becomes input for phase two.

Phase two consists of analyzing the statements and reducing them to a specified number of statements which should reflect all of the opinions stated in phase one. A numerical scale is assigned each of the statements and this questionnaire is then mailed to the participants. Each participant is asked to assign a numerical value to each statement, illustrating the importance he attaches to it. The questionnaire is then returned to the decision-maker.

In phase three, the ratings are then averaged, normally using either a median, mode or mean, whichever is judged to be appropriate. The questionnaire is then reprinted with the average value indicated for each statement. Each expert is also provided with his own previous rating. Each expert is asked to review the average group rating as compared with his personal rating. If these rating [rankings] are different, (s)he can either concur with the average or support his differing opinion. If he does the latter, he must give reasons for such action. The questionnaire is then returned to the decision-maker who may elect to end the process at this point (round three) by analyzing

the results for a consensus of opinion and a minority report, or (s)he may elect to go on to phase four.

The final step, phase four, if elected, provides each expert with new consensus averages and a summary of the minority opinions. A final revision of ranking is requested. The decision-maker then ties up the loose ends in the same manner as described above for phase three.

Some have been skeptical about the utility of gathering expert opinions or estimates related to problems. The literature is repleat with discussions of how to gather objective data, selection of a proper sample size, random design and the use of statistical tools. It would appear that data gathered by other than scientific means is of very questionable value. The practicality of using techniques in the process of decision making often necessitates using other than "hard data" for determining courses of action to follow. One author has suggested that in many cases, the use of judgmental data may be more useful than the objective data most decision-makers have relied upon in the past. A review of where expert orinion was more accurate than that which was based upon more statistical basis is provided by Kotler.[8]

Rasp reviews the Delphi method, calling it a decision-maker's dream.[9] He was director of program evaluation for the Washington State Superintendent of Public Instruction, Olympia, Washington. He suggests a number of key questions to be asked prior to using the Delphi method

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[8]Philip Kotler, "A Guide to Gathering Expert Estimates; A Treatment of Unscientific Data," Business Horizons, XIII (October, 1970), pp. 79-87.

[9]Alfred Rasp, Jr., "Delphi: A Decision-maker's Dream," Nations Schools (July, 1973), p. 32.

and concludes:

> Even in the face of limitations, the Delphi does have strength and utility. It collects and organizes judgments in a systematic fashion. It gains input. It establishes priorities. It builds consensus. It organizes dissent. In short, it cannot be overlooked as a useful and reliable decision-making tool.

The Delphi method has been applied to a variety of research problems as a tool employed in a number of doctoral dissertations. A number of selected studies are now briefley noted.

SELECTED STUDIES EMPLOYING THE DELPHI METHOD

One of the first research studies reported as a doctoral dissertation was mentioned earlier as one of business forecasting.[11] The other dissertations reviewed have utilized the Delphi method in a variety of other fields, including fund raising in Alabama,[12] educational decisions and time delay of feedback,[13] and the future of Women's College in the United States. Others include the effect of Delphi techniques on group

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[11] Campbell, op. cit.

[12] Samuel L. Newman, "The Use of Opinion Technology in Long Range Planning--A Study of the Delphi Process in Forecasting United Funds Needs in Tuscaloosa, Alabama" (unpublished Doctoral dissertation, University of Alabama, 1970).

[13] James Sherman Waldron, "An Investigation into the Relationships Among Conceptual Level, Time Delay of Informational Feedback, and Performance in the Delphi Process" (unpublished Doctoral dissertation, Syracuse University, 1970).

[14] Amelia R. Shannon, "A Delphi Study of the Future of Women's Colleges in the United States" (unpublished Doctoral dissertation, Lehigh University, 1971).

consensus in educational planning,[15] establishing criteria for the selection of a secondary school principal,[16] and on the applicability of the Delphi technique as a method of establishing educational goals.[17] Two recent studies which relate most closely of those reviewed to the present study include one by Margaret Jetter dealing with the roles of the school library media specialist in the future,[18] and another by Mary E. Kingsbury which is on the future of school library media centers.[19]

LEIK'S MEASURE OF ORDINAL CONSENSUS

Leik's Measure of Ordinal Consensus was developed so as to reveal a ratio of consensus which may be expressed in a percentage. This has a number of advantages. First, the measure is based upon the

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[15]Peter George Gazzola, "The Effect of the Delphi Technique on Group Consensus in Educational Planning" (unpublished Doctoral dissertation, University of Arizona, 1971).

[16]Jean Franklin Emmons, "Use of Delphi Technique in Establishing Criteria for the Selection of a Secondary School Principal" (unpublished Doctoral dissertation, Ohio State University, 1971).

[17]Edwin Herschel Griffith, "The Applicability of the Delphi as a Method of Establishing Educational Goals" (unpublished Doctoral dissertation, University of Iowa, 1973).

[18]Margaret Ann Jetter, "The Roles of the School Library Media Specialist in the Future: A Delphi Study" (unpublished Doctoral dissertation, Michigan State University, 1972).

[19]Mary E. Kingbury, The Future of School Library Media Centers, U.S., Educational Resources Information Center, ERIC Document ED 110 069, July, 1975.

assumption that a scale continum with choices such as strongly agree to strongly disagree, or an interval scale based upon priority ratings, is ordinal data. One cannot accurately assume all the intervals are of the same value in such a scale. Instead of a choice of "one-to-one value," it becomes a choice of "one-to-many." The use of standard deviation or variance is computed under the assumption of equal intervals, and if used may introduce considerable error if used with ordinal data. Leik's measure appears to be preferable as a measure of consensus to one based upon variance, because it makes no assumptions about intervals, it is easily computed, it is a percentage and hence has ratio properties, and it tends to be conservative.[20]

In Leik's examination of comparisons for interval or ordinal consensus, approximately 60 percent of skewed distributions examined, interval consensus measures exceeded ordinal consensus. Ordinal consensus therefore seems to better fit the observed data of the present study, reflecting more accurately the amount of consensus. However, one problem exists with Leik's Measure of Ordinal Consensus:[21]

> There is one aspect which poses an unsolved problem when using Ordinal Consensus. There is no way now available to estimate sampling variability; hence significance tests for the measure have not been developed and confidence intervals have not been constructed. Because there is not a one-to-one correspondence between a value of Ordinal Consensus measure and a given frequency distribution, but rather a one-to-many correspondence, a chi-square test of the similarity of two distributions will not test the hypothesis of similar Ordinal Consensus. Without assumptions about the intervals, allowing algebraic derivation of, e.g., a moment generating function, there seems to be no way to derive sampling variability of the index.

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[20] Robert K. Leik, "A Measure of Ordinal Consensus," Pacific Sociological Review, IX (Fall, 1966), pp. 85-90.

[21] Ibid., p. 88.

Since the design of the present study was not based upon a comparison of similar Ordinal Consensus of two samples, but rather an analysis of a single panel consensus, Leik's Measure of Ordinal Consensus appears appropriate and was therefore selected. The measure has been used with several studies in Educational Administration, including a study made by Foskett and Wolcott,[22] Hadley,[23] and Jacobson.[24]

FAULT TREE ANALYSIS

There are two basic approaches to making analysis of systems, the first being analysis in terms of success or accomplishment of purpose, and the second, the analysis in terms of failure or the lack of accomplishing a systems purpose. A systems approach normally followed the success analysis. Fault Tree Analysis is a relatively new methodology refined by Stephens and others to analyze systems in terms of failure to achieve a systems purpose. Fault Tree Analysis (FTA) has also been called "event logic network" because it provides a step by step procedure for graphically portraying a variety of combinations of possible occurrences in a system which may contribute or cause failure or the

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[22]John M. Foskett and Harry F. Wolcott, "Self-Images and Community Images of the Elementary School Principal," Educational Administration Quarterly, III (Spring, 1967), pp. 162-182.

[23]David T. Hadley, "A Forecast and Analysis of Educational Events Identified by Utah Educators" (unpublished Doctoral dissertation, Utah State University, 1969).

[24]James A. Jacobson, "Forecasting Future Development in Education" (paper presented at the American Educational Research Association Meeting, Minneapolis, Minnesota, March 4, 1970).

"undesired event."[25] Fault Tree Analysis has been defined as:[26]

> . . .a technique for enhancing the probability of *success* in any system by analyzing the most likely modes of *failure* that could occur. It provides a logical, step by step description of possible failure events within a system and their interactions--that is, the combinations of potential occurrences which could result in a predetermined undesired event (U.E.). The fault tree was so named because the completed graphic portrayal of a functional system utilizes a branching process analagous to the outline of a coniferous tree.

The potential of FTA is sometimes missed by those first exposed because of the predominant mode of thinking of success factors in our society. A diagram originally prepared by Stephens graphically displays the two routes for system analysis, shown on page fifty-six.

Recognizing the importance of analysis in terms of possible modes of failure, Stephens states:[27]

> Analysis in terms of success, however, is much more problematic than analysis in terms of failure. Not only is it difficult to achieve consensus as to those design characteristics and functions, the channels and interactions, which lead to systems success, but experience has shown that in complex systems, it is much easier to describe and achieve consensus as to what constitutes failure. When a system is functioning smoothly, it is not at all easy to specify precisely what combinations of events contribute to this happy state. But when breakdowns occur, they are immediately apparent, although their causes and their "downstream" effects may be more obscure.

Fault Tree Analysis consists of events, connected or interrelated by logic gates, which tie together in complex pathways. The first step is to identify and state precisely the undesired event (U.E) which is of critical importance in the system. In the present study it

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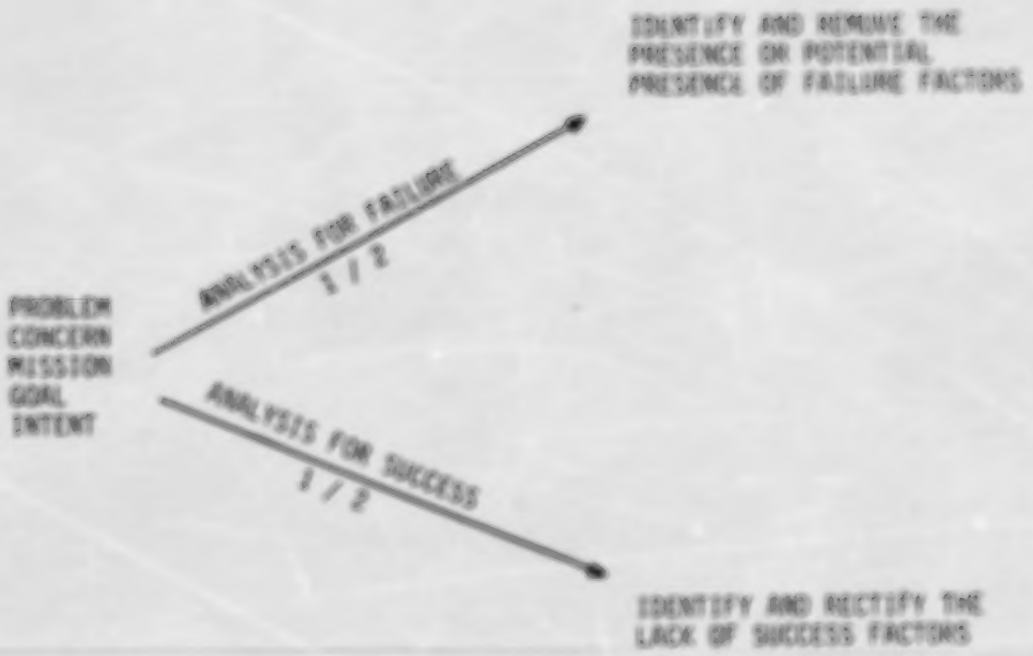
[25] Witkin, Belle Ruth and Kent G. Stephens, Fault Tree Analysis: A Research Tool for Educational Planning, U.S., Educational Resources Information Center, ERIC Document 039 379, 1968.

[26] Kent G. Stephens, "A Fault Tree Approach To Analysis--An Overview," (Provo, Utah: Department of Educational Administration, Brigham Young University, February 13, 1974), p. 1.

[27] Ibid.

Figure 3

Two Routes for System Analysis



Source:

Kent G. Stephens, Distinguished Faculty Lecture, Utah State University, Logan, Utah, August 7, 1974.

to the failure to make improvements in teacher use of library media centers. The events leading to this undesired event is the second part of the problem to be explored in the study, as portrayed in Figure 3 on page fifty-six. By identifying the competencies or needs of teachers in successfully using library media centers, through using expert opinion developed by the Delphi method, the input will be developed along with the review of the literature, to identify modes of possible system failure. These modes are used in the FTA approach to identify factors which may be overlooked in the analysis of success factors. FTA may yield inputs which may be used by decision-makers, and combined with the Delphi technique (DEFT: Delphi Fault Tree) may prove a more powerful tool for instructional development than the methodologies used separately. While Delphi may focus upon general inputs, FTA tends to focus the thinking of groups or individuals upon specifics and to organize them in a systematic framework. It also focuses on interdependencies which may be as important as the various events which transpire within a system.

A discussion of fault tree analysis methodology following is an overview briefed from the work of Stephens. Explanations of both qualitative and quantitative analysis by FTA, with examples of educational and management information applications illustrated by a prototype fault tree are found in Stephens' dissertation completed in 1972.[28] Other papers helpful to those who wish to pursue FTA further

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[28]Kent G. Stephens, "A Fault Tree Approach to Analysis of Educational Systems as Demonstrated in Vocational Education" (unpublished Doctoral dissertation, University of Washington, 1972).

include a technical report available at time of writing from Alameda County School District, Hayward, California,[29] and a paper presented by Wilshire and Stephens at the Western Speech Communication Association, Honolulu, Hawaii, November 10-12, 1972.[30]

A Brief Overview of Fault Tree Analysis

Stephens points out that the heart of the fault tree approach and the major differentiation from other forms of systems analysis is the use of logic gates. These logic gates show relationships among events, and consist of two principal kinds, the AND gate and the OR gate. All other gates used in FTA are derivatives of these two types. The symbols used for AND gates is: The symbol for OR gates is:

The AND gate describes the logical operation whereby the coexistence of all input events is required to produce the output event. The OR gate defines the situation whereby the output event will exist if one or more of the input events exists. Most human systems have many OR gates and few AND gates. Figure 9 on page sixty which shows the AND and OR gate

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[29]Nolla Ruth Wilshire and Kent G. Stephens, Fault Tree Analysis: A Management Science Technique for Educational Planning and Evaluation (Technical Report Number 21, Alameda County School Department, Hayward, California, 1972).

[30]Nolla Ruth Wilshire and Kent G. Stephens, "A Fault Tree Approach to Analysis of Organizational Communication Systems" (Honolulu, Hawaii: Western Speech Communication Association, November 10-01, 1972), 32 pp. Also on ERIC Document ED 081 336.

tybology in relationship to the rectangle: which is used to depict events in a fault tree.

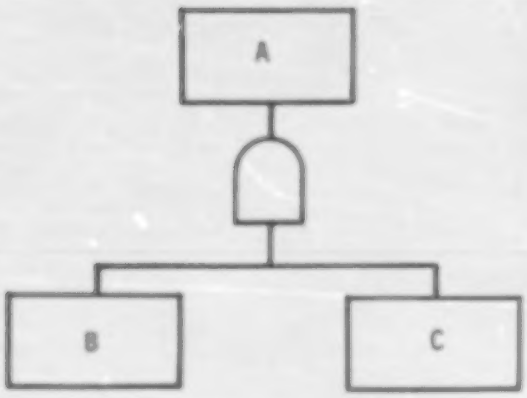
In behavioral systems, the AND relationship depicted by the AND gate most commonly exists when a subsystem or component and one or more backup systems or components exist or are possible within the design of the system. The AND situation occurs with less frequency in behavioral than in hardware systems.

The OR relationship is the most common relationship in behavioral systems and is important to consider in the application of FTA. In the present study, all gates were of the OR variety. The OR gate is used when, of two or more possible inputs to an event, any one alone could produce the output to the next level event. There are two general kinds of OR gates-- the INCLUSIVE OR and the EXCLUSIVE OR. The INCLUSIVE situation shows that either B or C events or both could result in causing event A to occur, as shown in figure 4 on page sixty, and may in fact happen simultaneously. The EXCLUSIVE OR situation is where either A or B could produce event C, but both A and B could not occur simultaneously.

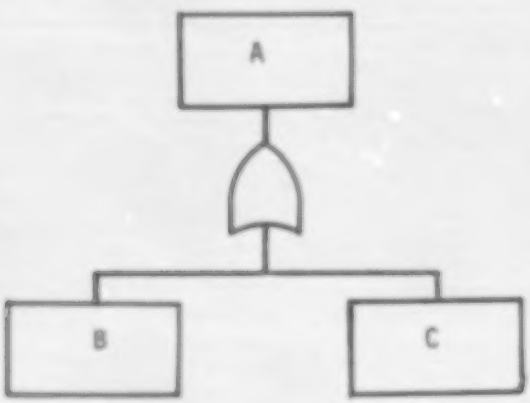
Variation of the logic gates allow for specifying complex relationships. The FTA provides precise description of conditions as well as modes of relationships, which may be expressed mathematically and quantified. This quantification may be used to derive strategic paths by ranking the order of relative contributions or importance of each of the failure events leading up to the top undesired event in a fault tree. A modified oral Delphi technique is helpful in the ranking process.

Figure 4

FTA Logic Gates



The above tree is read: Events B and C must coexist to produce event A; or, the output can occur only if the inputs B and C coexist. The mathematical equivalent of the is A = (B▲C).

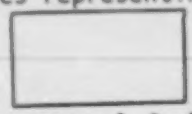


The above tree is read: Either B or C events alone will produce event A. The mathematical equivalent of this is A = (B▼C).

Source: Witkins and Stephens, . . . Management Science Techniques, op. cit.

Summary of Basic Fault Tree Analysis Symbols

The basic FTA symbols include the following described and illustrated shapes representing expressed relationships.

Rectangle:  Identifies an event that results from a combination of less general fault events through an associated logic gate. All events symbolized by rectangles have additional development in the fault tree.

Circle: Identifies a basic failure event that requires no further development. This could occur when the definition of an event is sufficiently explicit to satisfy the purpose of the analysis. It also occurs when there is a "primary" failure of a component, analogous to a power failure in a telephone system. The decision as to whether the event is a basic one or not depends somewhat on the perspective of the analysis. For example, if the telephone system itself were being analyzed, then events leading to a power failure would be traced in much more detail. However, if a telephone is considered one system component within an organizational communication system, a power failure might be considered a basic event requiring no further analysis. *It is important to note that FTA is not a system to necessarily analyze all possible failure events, but the major events which by common sense are identified as worthy of analysis. FTA may be kept practical and useful or may be made much too tedious and cumbersome for the general applicattons. The "KISS" principle is important to keep in mind, that is as a mnemonic to keep it simple systematically. The power of FTA is that it may be made as detailed or as general as fits the situation under analysis.*

Rhombus: Identifies an event which is not developed further due to (a) lack of information, (b) very remote likelihood of occurrence, or (c) because time, financial or other constraints preclude further analysis. *This symbol should not be confused with the diamond used as a decision point in flowcharting.*

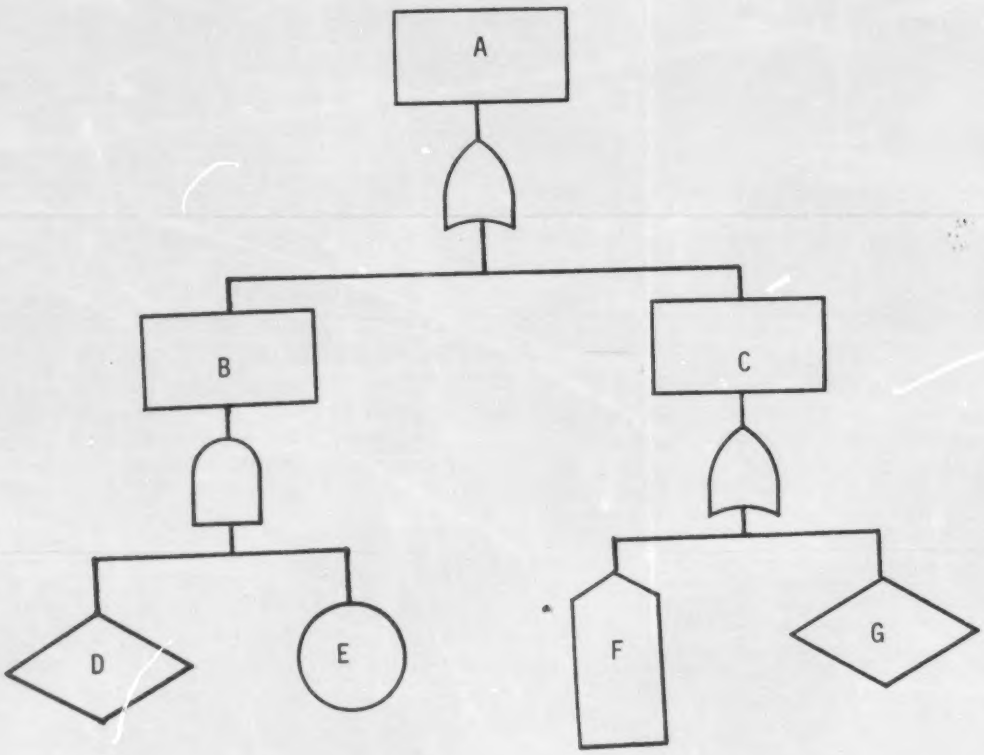
House: Identifies an event that is normally expected to occur in the systems defined. When combined with other events, however, it might contribute to a failure event.

The symbols are shown on the rudimentary fault tree branch following on page 63 as figure 5. In analysis of possible failure, <u>any</u> event at the bottom of the tree which passes only through OR gates to more general failure events at the top of the tree becomes the same event, in essence, as the undesired event to which they are tied. *To reiterate this important principle: <u>any</u> event at the bottom of the tree which passes only through <u>OR</u> gates (the most common gate in human or behavior systems) to more general failure events at the top of tree becomes the same event, in essence, as the undesired event to which they are tied. That is if a lower failure event occurs, then the top event will also occur, and by an "accordion logic" the events of the tree in that branch are compressed together as one event, which that top failure event.*

Another observation to make is that it may appear to the reader that analysis of failure is simply the logical reciprocal of analysis for success. *Experience has shown, however, that this is <u>not the case</u> and failures may be caused by other than the reverse factors for success!* FTA provides more than the logical inversion of success analysis. It

Figure 5

Rudimentary Fault Tree Branch



The symbols shown on the above fault tree branch may be interpreted or read as:

Event A can be produced either by event B or event C or both. Event B can be produced only by the coexistence of events D and E. Event C can be produced either by event F or event G or both. Event E is a primary or basic failure event, and event F is an event that normally occurs in the system, but which can contribute to event C. Events D and G require no further analysis.

Source: Stephens, ...Overview, op. cit., p. 6.

generates questions about systems which normally do not occur with the inspection of success factors. The FTA methodology, which facilitates consensus formation processes for groups, promotes team building activities which, in turn, lead to greater success and more productivity of team efforts.

Quantitative FTA is the process of ranking in order the relative contribution of each event which leads to the undesired event (U.E). One determines for all of the inputs to a single event the percentage contribution made by each event to the more general failure event above it, utilizing a consensus process. Percentages of lower events should sum up to 100 for each next higher event. It is not necessary for all team members (panel of experts) to be knowledgeable beyond the rudimentary elements of FTA to work effectively in the process. Team members should represent many different levels and functions within the organization and should however, have a good knowledge of the system under analysis.

Fault Tree Analysis has a short history, with the first concepts developed by Bell Telephone Engineers as a technique for performing a safety evaluation of the Minuteman Missile Launch Control System. The Bell engineers discovered the FTA used to describe the "correct" logic for processing equipment could also be used for analyzing the "false" logic which resulted from component failures. Later it was used in analysis of hardware systems by the Boeing Company, and since its introduction in 1961, successful utilizations are application to a variety of systems, such as vocational education, instructional media systems, educational organization, redesign and development, staff development, community college needs assessment, and basic research. FTA is currently being applied to administrative

settings in the development of a new management theory identified as "managerial stewardship." Recently Stephens has contracted with the U.S. Naval Training Command to conduct a Fault Tree Analysis on the implementation of an instructional model to be used throughout the entire Naval Training Command.

Steps in Construction of the Fault Tree

As noted earlier in this study, Fault Tree Analysis (FTA) is a technque for increasing the probability of success in any system by analyzing the most likely modes of failure that could occur. A fault tree provides a logical, step by step description of the various occurrences of events within a system which could result in failure of the system. The objective is to isolate and identify possible failure modes and thereby rectify or avoid them. The purpose of FTA is not to analyze all events in a system, but the major events which might lead to failure of the system. FTA aids in answering the question "Why a system fails or might fail?" To construct a fault tree one seeks expert advise, consults the literature and brainstorms with groups. These same processes were used in the construction and validation of the fault tree produced by the present study.

The initial "scoping of the tree" is shown on page sixty-six as figure 6. The functions and terminology were based upon a recent and standard source in order to keep a commonality to the study.[31]

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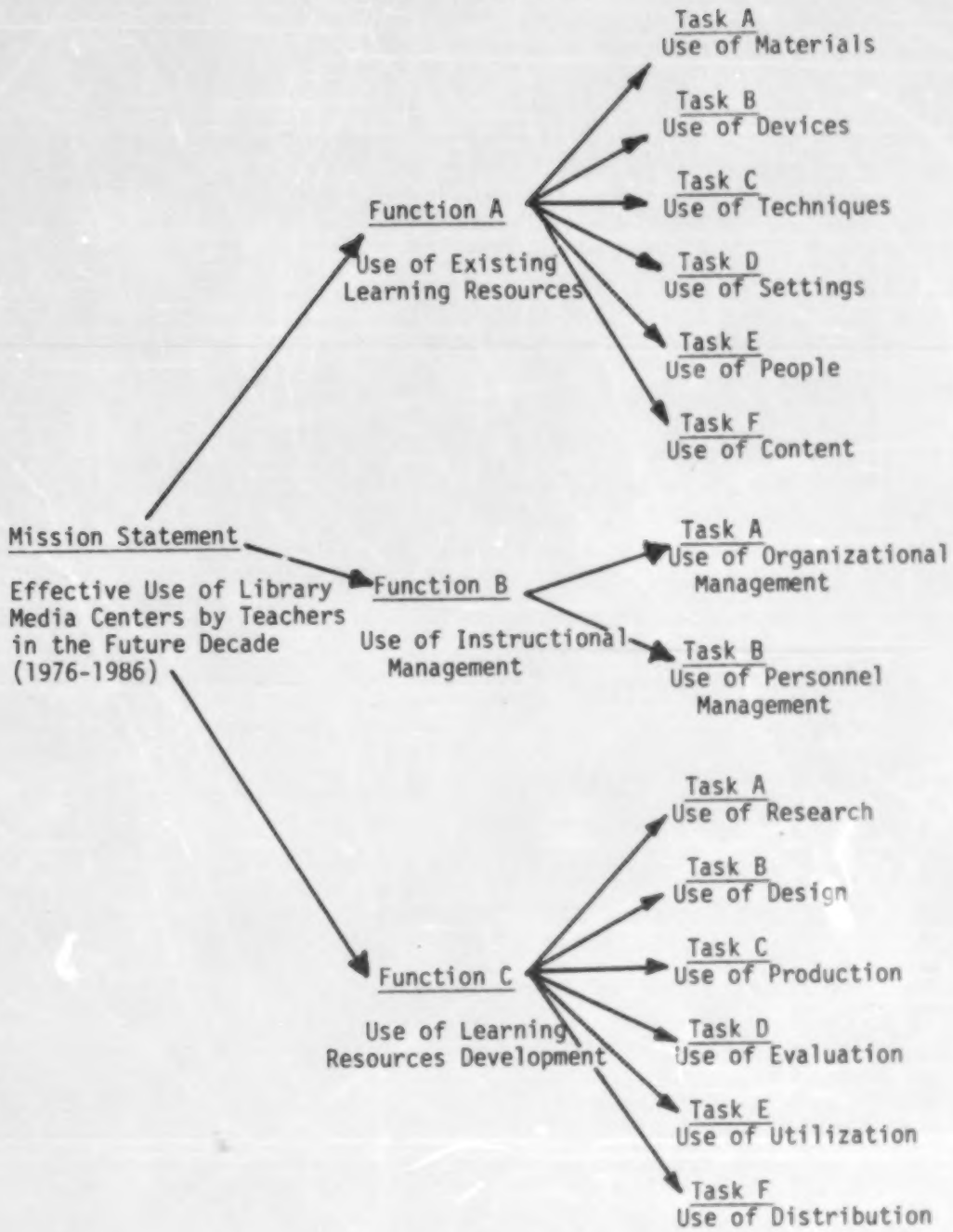
[31]Howard Hitchens, James C. Wallington and Susan D. Hawkins. Educational Technology: A Handbook of Standard Terminology and a Guide for Recording and Reporting Information About Educational Technology. (Washington D.C.: U.S. Government Printing Office, 1975).

Figure 6

Scope of Fault Tree



During the early stages of the study, two attempts were made in field testing the applicability of qualification of the fault tree by mail. Graduate students and faculty of the Department of Instructional Media at Utah State University were used as the pilot groups. In each case, it was found that the mail approach to gathering the data for the fault tree construction was not feasible, but that it could be used for developing some of the inputs. The data for the fault tree construction was taken from the initial inputs of the national panel of experts during the Delphi phase and from the literature. In addition, the USU IM faculty became involved in the project in another way.

The author wrote a grant proposal to fund a two day research retreat for the full faculty June 24-25, 1976, at Sweetwater Resort on Bear Lake, Utah. The Bureau of Educational Research Services provided the funding and all members attended. The purpose of the retreat was to draft new goals and research thrusts for the Department of Instructional Media to better fit the new College of Education and University Research goals for the next ten years. The meetings produced a document labeled "Master Resources Teacher Concept." The focus of the new research efforts of the IM Department members as a total unified force for the next decade (1976-1986) will be directed to developing that concept.

On July 16, 1976, eight members of the Instructional Media faculty met as a group to quantify the original fault tree on "Teacher Use of Library Media Centers" earlier completed by the author on June 30, 1976. The process revised the mission statement as "To Make Improvements in Teacher Use of Library Media Centers." To that statement was added the prefix statement of "Failure of Mission: . . ."

thereby identifying the undesired event (U.E.) to serve at the apex of the tree. Functions were identified as a) use of existing learning resources, b) use of instructional management and c) use of learning resources development. Six tasks were identified related to use of existing learning resources, two tasks related to use of instructional management and six tasks related to learning resources development. These formed the "scope of the fault tree" as reflected in figure 6 displayed on page sixty-six. The original draft of the tree was suggested by the following model.[32]

Figure 7

Components of Educational Technology

Stephens has suggested several advantages of the Fault Tree Analysis methodology which are given to conclude the discussion of FTA. They serve to focus upon the rationale for using FTA in the present study and the conditions under which FTA has been found useful.

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[32]Hitchens, Wallington and Hawkins, ibid., p. 5.

Advantages of FTA

The advantages of using the FTA methodology are:[33]

1. It focuses expert knowledge and judgment from often widely disparate disciplines and functions on a common problem and furnishes a common language and perspective.

2. It can take into account both agreements and divergences on the inputs and their importance.

3. It allows for concentration on one area of interest at a time, but with the assurance that all other areas will be systematically dealt with.

4. By concentrating on the way the system operates, rather than on personalities, it introduces a non-threatening atmosphere and encourages freer exchange of information among the members.

The conditions under which FTA has been found useful include whenever:[34]

1. undesired events or concerns and factors contributing to those concerns can be identified.

2. Involvement of the members of an organization needs structure and systematizing.

3. Differing areas of expertise must be marshalled.

4. A defensible approach to resource allocation within a complex system is needed.

5. Consensus as to what constitutes success in the system is difficult to obtain.

6. Formative evaluation is necessary.

7. The primary and secondary effects of future decisions must be analyzed.

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[33] Stephens, . . . Overview, Ibid., p.16-17.

[34] Stephens, . . . Overview, Ibid., p. 18.

SELECTION OF PANELS OF NATIONAL AND LOCAL EXPERTS

Because of the complexity of the problem of analyzing teacher use of library media centers in the future, the Delphi-Fault Tree Analysis methodology was selected to be used with a panel of experts, both a local panel and a national panel. Letters were written to ascertain the willingness of experts to serve on the panel. Some 475 letters were directed to individuals who were asked to nominate persons who had expertise and interest in teacher use of library media centers. These letters were sent to Deans and Directors of Library Schools accredited by the American Library Association and Schools of Education accredited by the National Association of Colleges for Teacher Education (NACATE) and state departments of Public Instruction. Based upon the distribution by regions (the regional divisions made by the United States Office of Education) and the need to get experts with a variety of experience as teachers, librarians, media specialists, instructional technologists, from the letters sent, ninety-five persons responded that they would be interested in the project problem and would be pleased to serve. Thirty-six experts were selected from those ninety-five and were sent letters to confirm their acceptance to serve on the national panel of experts.

The national panel selected includes a number of prominent authorities in education and library media center related programs. A list of these experts serving on the national panel are included in appendix A. As one may note, they include Directors, Deans, Department Heads, Professors and Specialists from large, well known institutions, as well as the lesser kn[illegible] and some associated with State Departments of Public Instruction and Professional Associations.

DEVELOPMENT OF THE INSTRUMENTS

The first questionnaire used in the study was similar to one recently reported in the literature.[35] It was kept simple in design to encourage as wide a range of input as possible and is displayed in appendix C. Questionnaire number one was used to build the Delphi Questionnaire number two, which includes items developed from the input from questionnaire number one. A copy of the Delphi questionnaire number two is included as appendix D.

The first questionnaire asks basically what teachers should be able to do, should know and how they should feel about library media centers during the next decade, 1978-1988. In addition lead words such as increase, maintain, reduce and develop were added to what institutions of higher education involved in teacher education should do in the future in the area of library media center preparation of teachers. The second Delphi questionnaire lists fifty-eight items generated and refined from the data collected by use of the first Delphi questionnaire, and was used as the third Delphi questionnaire with the panel ratings along with each individual rating printed over the original form. The consensus was to generalized by the end of the third Delphi round of questionnaires, that a fourth round was not deemed useful and the Delphi study concluded.

The inputs from the Delphi study and the literature, plus the brainstorming with the Department of Instructional Media faculty, served to give a basis to generate the data necessary to construct the

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[35]Kemp, Ibid., p. 30.

fault trees for the study. Slightly more than 250 hours were expended by the author in the creation and drafting of the trees. The procedure used was to analyze and classify each original input into the structure suggested by the recently published handbook on risk-control technology.[36] The fault trees were then constructed by drafting the various failure events classified, into the schematic displayed in the appendices 3 through 6.

The fault trees were displayed in a large center-conference room with a large table and comfortable side chairs so the panel could work efficiently but in a pleasant atmosphere. Refreshments were provided throughout the quantification process which lasted for most panel members over the entire eight hour day of Friday, July 16, 1976.

During the quantification process with the local panel, the author was present to clarify or amplify the written instructions displayed in appendix F, and to lead the process by answering questions of procedure and encouraging interaction of the panel members in a modified oral Delphi. For a more detailed review of this procedure, a discussion is given in another FTA study completed recently.[37] The local panel of experts, with the help of the author, spent sixty-one man hours in the quantification process of the trees made up of 300 events. The original trees quantified were drafted on a roll of drafting paper measuring thirty-seven feet long and included all labels written in the symbols of the trees.

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[36]Hitchens, Darrington and Haskins, 1976.

[37]James A. Watson, "A Fault-Tree Analysis of Selected Policies, Procedures and Characteristics of the College of Business Risk" (unpublished doctoral dissertation, Brigham Young University, 1976), pp. 30-37.

The schematic displayed in appendicies G through M is a facsimile of the constructed fault tree, with the lables listed after each major division of the tree and the critical event values shown in the symbols in place of the labels which appeared in the symbols in the original draft of the tree.

The quantification input from the local panel was then keypunched directly from the FT Quantification Forms and the punched data run through the FTAP (Fault Tree Analysis) Program using the Brigham Young University Computer services. The forms so used were precoded identifying all events by letters as shown in the sample form displayed in appendix F which matched the letters shown on the fault tree events displayed on the wall of the seminar room (the letters now identifying the symbols on the schematic displayed in appendicies G through M).

The constructed fault tree was a bit more complex than is normally used in that it contained some clusters of events numbering up to ten as inputs to the next higher level events. This was explained to the panel as a technique to avoid the creation of pseudo-logic gates. The local panel of experts reported little difficulty in dealing with the number of events but expressed that written abreviated name titles of events in addition to the letter designations of the FT Quantification Form would have been helpful.

FUNDING FOR THE PROJECT

Soon after the conceptualization of the design for the research study, a grant proposal was written and submitted by the investigator to the Utah State University of Educational Research Services and the

Utah State University Development Fund. The funding received allowed the payment of a $25.00 honorarium to the national panel of experts members and supported the initial correspondence needed to initiate the study, which was titled "The NATUL Project," Needs Assessment for Teacher Use of Library Media Centers in American Public Education.

SUMMARY

In summary, the research design employed the Delphi methodology in conjunction with the Fault Tree Analysis to deal with the problem directed to teacher use of library media centers in the future. The initial part of the study employed the Delphi methodology to identify needs which the national panel of experts viewed as necessary for success of the teachers, and in the second phase of the study the Fault Tree Analysis was used to identify possible modes of failure of teachers to effectively use library media centers in the teaching-learning process.

Attention was directed to both the factors of success and the causes of failure so as to apply a complete systems analysis design. As experience with this study and others has shown, factors of failure are not necessarily the reciprocal factors of success and provides the rationale behind the use of both tools of research. The research design of methods and procedures makes a new application of FTA and Delphi for needs assessment for instructional development and is coined the "DEFT" system.

Chapter 4

PRESENTATION AND INTERPRETATION OF DATA

Professional educators from Library Schools, Colleges of Education, practictioners from the field, specialists from state departments of public instruction, and a professional education officer of the American Library Association were among the thirty-six persons comprising the national panel of experts used in the study.

Geographically, these experts were from all major regions of the United States, including the west, southwest, central, northeast, southeast and southern areas. The ten regions as utilized by the United States Office of Education each included experts excepting region two, made up of the state of New York, the Virgin Islands and Puerto Rico.

The group of experts drawn from the nation at large included twelve specialists from Library Schools; eleven specialists from Colleges of Education, six educational media specialists from Universities and Colleges; two College Library Directors; one Audiovisual Center Director at the University Level; one Educational Research Center Director; one State School Library Specialist; a Public School Instructional Media Coordinator; and one specialist serving as the full time executive officer of the American Library Association Committee on Accreditation. That person accepted the new assignment with ALA during the study. All experts on the national panel were selected upon recommendation from Deans of accredited Colleges of Education (NACATE) or Library Schools (ALA) as specialists with expertise and experience in use of school library media centers. Twenty-four

of the national panel members hold terminal degrees, with all holding at least the master's degree. Those with only the master's degree had considerable experience in public education, and all panel members had public education experiences. Each member was chosen to represent various segments of the library media field, education and practicioners, as well as to represent geographical areas of the United States. This was done on the assumption that a composite view of the future needs would be more realistic than would a forecast from a less representative sample. A random sample was not deemed appropriate under the circumstances of the requirements of the study.

A series of three Delphi questionnaires were sent to the thirty-six experts, as is done in a standard Delphi study. However, a mean was calculated as feedback to the panel rather than the mode or medium, as is sometimes done. In the third round of the Delphi, the experts were asked to justify any variations in responses from the mean, or their response would be interpreted as in agreement with the mean. Most panel experts indicated their agreement by this round of the study.

The first round of the Delphi was completed by ninety-seven percent of the experts, with thirty-five of the thirty-six responding. The investigator attributes this high response to the solititation of letters of acceptance by the panel members after they had received a detailed description of the study and their tasks, including the details of the small honorarium to be paid to each expert. Payment was suggested by Martino in his review of the Delphi techniques, as much more time and effort are required over an extended period than is required in other research designs.

Martino states that:[1]

> With the exception of the experimental panels used at the Rand Corporation, probably most of the Delphi sequences run to date have used unpaid panelists. Out of several dozen sequences, the author is aware of only three forecasts produced by paid panelists. However, this situation cannot last, and probably should not. Panel directors in either business or government, seeking forecasts on which to base specific policy recommendations, should be willing to pay their panelists. The level of payment should correspond to that for an equal amount of consulting service.

The investigator estimated that approximately two to eight hours time would be expended by each expert, and a token sum of $25.00 was made possible by a research grant as described earlier in chapter three. Although a minimal amount was paid, it is evident that the payment did have an affect in increasing the percentage of returns throughout the study.

The second round of the Delphi produced an eighty-three percent return, with the third round also producing an eighty-three percent return. The fourth round as mentioned in chapter three proved unnecessary because a consensus was discovered in the third round.

DELPHI PHASE AND DISCUSSION OF QUESTIONS

The first three questions stated as part of the hypothesis are repeated prior to the discussion, so as to give focus to the Delphi phase of the study. They are:

> 1. There is no consensus of national experts as to what teachers should know and what they should be able to do in effectively using library media centers.

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[1] Joseph P. Martino, Technological Forecasting For Decisionmaking (New York: American Elsevier, 1972), pp. 59-60.

2. There is no consensus of national experts as to what library media center learning experiences teacher educators should provide future teachers.

3. There is no identifiable and specifiable needs for the improvement of teacher education programs in terms of teacher use of library media centers.

These statements were made as null hypothesis to test questions concerning teacher use of library media centers which could be answered by analysis of the observed ordinal data generated by the Delphi technique. The first question is tied to items one through thirty-three on the checklist produced by the Delphi study. The items included a variety of situations for which the statements "future teachers should know" and "future teachers should be able to" are used to tie to knowledge and skills (competencies).

The first grouping of items includes such things as knowing the characteristics, functions and services of a library media center as contrasted with the traditional predominantly print library; and knowing basic communications theory and how it may be applied to media use. These items are displayed as items one through ten in table 1, page 79. The percentage levels of consensus for Delphi two and three are shown, along with the mean priority values (group means).

An examination of the panel consensus scores as displayed in table 1 reveals a high level of consensus as computed following Leik's formula for Ordinal Consensus. A consensus score of seventy-five percent is accepted in the present study as defined consensus although Leik has suggested that a score of fifty percent is a line of moving toward consensus. Some studies have accepted fifty percent as consensus[2] but

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[2]Jacobson, Hadley and Foskett-Wolcott studies, loc. cit.

Table 1

Consensus Scores, Mean Priority Values and Ranking for items 1 through 10 dealing with what teachers prepared during the decade of 1976-1986 should know related to library media centers.

Item Numbers and Ranking *	Mean Priority Values **	Delphi Two Consensus Score by %	Delphi Three Consensus Score by % ***	Shortened Item Statements For "Future Teachers Should Know"
1/6	5.167	68	100	the characteristics, functions and services of a LMC
2/12	4.833	59	96	how to use standard, authoritative sources of information
3/18	4.533	57	93	how to use standard, authoritative sources of media
4/15	4.733	37	89	basic communication theory and how it may be applied to media
5/5	5.267	61	99	how learning theory and curriculum alternatives relate
6/8	5.033	63	98	the unique and specific values of all classes of media
7/28	3.900	53	84	the value of visual literacy processes
8/21	4.400	49	86	a general overview of children's and young adult literature
9/26	4.267	65	95	how to determine grade levels and interests
10/11	4.933	65	95	what one role the media specialist holds as it pertains to production, instructional development . . .

*Items ranked with all other items concerning the teacher - number/rank

**Values were given on a scale from 1 (low) to 6 (high)

***A value of 75 percent accepted as consensus using Leik's Measure

that level seems rather low to indicate strong consensus. A score of 100 percent indicates absolute consensus with all panel members agreeing on the mean priority value which was calculated after the second round of the Delphi. With this analysis of data collected in rounds two and three of the Delphi phases of the study, it is possible to assign rank order of the items by priority and show the level of consensus. All items as displayed on what teachers should know related to library media centers indicate a high level of consensus of the panel members as prioritized. Of the items, the lowest consensus score of eighty-four percent for item seven dealing with visual literacy and the highest score is posted for knowing the characteristics, functions and services of LMC's (library media centers) as contrasted with the traditionally predominantly print library. The grouping of these items of what teachers "should know" are indicative of the knowledge needs as contrasted with the competencies which are grouped in items eleven through thirty-three identifying what teachers should "be able to do" in the future. Those competency items are displayed in table 2 on pages 81-82.

Analysis as shown in table 2 reveals a high level of consensus for all items except item twenty-five. Although near defined consensus is observed, that item did not receive the seventy-five percent required. The items which received highest priority values were items 11, 12, 14, 15, 17, 18 and 20. It should be noted that these same items were also rated at absolute consensus level of 100 percent by the panel of experts. The items are given in full so the reader need not be forced to review the entire instrument displayed in appendix D.

Table 2

Consensus Scores, Mean Priority Values and Rankings for items 11 through 33 dealing with what teachers prepared during the decade of 1976-1986 should be able to do as related to library media centers.

Item Numbers and Rankings *	Mean Priority Values **	Delphi Two Consensus Score by %	Delphi Three Consensus Score by % ***	Shortened Item Statements For "Future Teachers Should Be Able To Do"
11/1	5.500	81	100	work as part of an instructional team
12/9	5.00	69	92	use specialized media personnel
13/3	4.333	64	92	teach students basic information retrieval skills . . .
14/3	5.333	74	100	guide and motivate students to use LMC . . .
15/2	5.433	78	100	use inquiry methods . . . through use of LMC . . .
16/13	4.733	63	94	assume leadership role in using LMC . . .
17/4	5.333	74	100	plan, organize and use appropriate media, equipment
18/7	5.167	67	100	develop learning objectives . . . which use media . . .
19/32	3.233	61	84	individualize instruction through use of CAI . . .
20/27	4.233	69	100	integrate and utilize resources, equipment of LMC . . .
21/24	4.33	55	97	utilize mass media (TV, radio newspapers) effectively . . .
22/10	4.967	62	95	assist in selection of materials for LMC . . .

*Items ranked with all other items concerning the teacher - number/rank

**Values were given on a scale from 1 (low) to 6 (high)

***A value of 75 percent accepted as consensus using Leik's Measure

Table 2 continued

Consensus Scores, Mean Priority Values and Rankings for items 1 through 33 dealing with what teachers prepared during the decade of 1976-1986 should be able to do as related to library media centers.

Item Numbers and Rankings *	Mean Priority Values **	Delphi Two Consensus Score by %	Delphi Three Consensus Score by % ***	Shortened Item Statements For "Future Teachers Should Be Able To Do"
23/16	4.700	61	93	analyze and evaluate commercially produced materials . . .
24/14	4.733	51	92	operate standard media equipment such as projectors . . .
25/33	3.200	42	72	trouble shoot minor eqipment problems . . .
26/30	3.833	48	84	produce basic instructional materials . . .
27/25	4.300	48	89	select and/or produce materials . . . reduce antagonisms . . .
28/29	3.900	60	95	guide students in production of basic . . . materials . . .
29/19	4.433	56	90	use a systems approach to media use . . . learner needs
30/22	4.367	50	93	explain why no type media may replace them . . .teachers
31/17	4.533	54	94	function as instructional managers in using LMC . . .
32/31	3.800	43	94	manage selected activities, such as "peer tutoring" . . .
33/20	4.533	55	88	plan their own continuous study and self evaluation

*Items ranked with all other items concerning the teacher - number/rank

**Values were given on a scale from 1 (low) to 6 (high)

***A value of 75 percent accepted as consensus using Leik's Measure

As a result of the experiences provided by Teacher Educators, future teachers should be able to:

11. work as part of an instructional team in achieving instructional goals and objectives.

12. use specialized media personnel to support instruction.

14. guide and motivate students in use of library media centers such as viewing, listening and reading activities.

15. use inquiry methods (learning how to find out, how to synthesize and encourage creativity) through the use of library media centers.

17. plan, organize and use appropriate media, equipment, technologies and personnel to allow students to take more responsibility for their own learning.

18. develop learning objectives which take into account individual differences and individualized instruction through the use of single and multi-media.

20. integrate and utilize the resources, equipment and services of library media center programs to support classroom instruction and learning.

The data collected and analyzed concerning teacher educators are displayed in table 3 on pages 84-85. These items were designed to identify what teacher educators should do in the next decade in preparing teachers in the use of LMC's.

The data displayed and analyzed in tabe 3 reveal a high consensus of the priority ratings by the national panel of experts. Items 37, 40, 49 and 58 received absolute consensus with allof these items given a priority of 5 or higher. The items are given in full so as to permit the reader avoiding the review of the instrument displayed in appendix D for the full statements:

During the decade of 1975-1986 teachereducators should:

37. use library media centers as important resources in the development of new methods and ideas in education.

Table 3

Consensus Scores, Mean Priority Values and Rankings for Items 34 through 50 dealing with what teacher educators should do during the decade of 1976-1986 in preparing teachers to use library media centers.

Item Numbers and Rankings *	Mean Priority Values **	Delphi Two Consensus Score by %	Delphi Three Consensus Score by % ***	Shortened Item Statements for "Teacher Educators Should"
34/19	4.500	65	96	individualize undergraduate teacher education
35/16	4.667	61	85	analyze changes in social values and concerns . . .LMC
36/8	5.200	69	99	develop more support for the development of LMC . . .
37/2	5.367	75	100	use library media centers as important resources . . .
38/15	4.733	66	95	increase supportive staff for Professors of Education . . .
39/14	4.733	66	96	humanize teaching-learning processes in teacher education
40/1	5.500	80	100	develop more effective . . . use of LMC's . . .
41/5	5.172	68	99	select cooperating teachers who effectively use media. . .
42/3	5.207	69	100	provide exposure to exemplary LMC's to teacher education
43/6	5.117	68	99	emphasize . . . life-long learning supports by LMC's
44/11	4.897	64	98	provide more simulated teaching experiences using media. . .
45/20	4.172	61	90	provide competency-based course work. . .through media

*Items ranked with all other items concerning teacher educators - number/rank

**Values were given on a scale from 1 (low) to 6 (high)

***A value of 75 percent accepted as consensus using Lehl's Measure

Table 3 continued

Consensus Scores, Mean Priority Values and Rankings for Items 36 through 58 dealing with what teacher educators should do during the decade of 1978-1988 in preparing teachers to use library media centers.

Item Numbers and Rankings *	Mean Priority Values **	Delphi Two Consensus Score by 5	Delphi Three Consensus Score by 6 ***	Shortened Item Statements for "Teacher Educators Should"
36/9	4.966	69	99	increase emphasis on teaching . . . communication skills . . .
37/17	4.586	59	93	provide general education for student teachers . . .
38/24	2.724	60	80	emphasize subject and field mastery . . .
39/8	5.00	65	100	demonstrate effective teaching-learning . . . media use . . .
40/10	4.931	62	97	help students integrate media with concept development . . .
41/22	3.862	47	91	increase . . . lab work . . . in producing materials . . .
42/23	3.793	38	91	increase . . . lab work . . . in using media equipment . . .
43/6	4.931	69	73	increase formal course work . . . LMC's . . . learning . . .
44/21	4.000	48	91	develop experimental product development centers . . .
45/25	1.621	70	99	emphasize book-centered learning . . . classroom . . .
46/12	4.828	90	96	develop a philosophy of education . . . LMC's . . .
47/13	4.707	56	96	develop content in post training . . . media use
48/7	5.067	69	100	develop better integration of media . . . programs

*Items ranked with all other items concerning teacher educators - number/rank

**Values were given on a scale of 1 (low) to 6 (high)

***A value of 75 percent accepted as consensus using Lahr's Measure

61. develop more effective ways for incorporating the use of library media centers into teacher education.

68. provide methods courses which demonstrate effective teaching-learning techniques using media as aids/materials to teachers.

72. develop a better integration of media in present programs by utilizing professors of media and library as consultants in curricular structure and course planning for teacher education.

All but item 53 dealing with increasing formal course work for teachers to use library media centers in the teaching-learning process met at the 75 percent level for accepted consensus. It was 73 percent, so very near defined consensus.

Of the total 58 items, 51 items received absolute consensus, with all of those 51 items rated 5 or more by priority value assigned. A high level of consensus was discovered for all items but two, 20 and 53. They dealt with "trouble shooting" equipment problems and increased course work.

TESTING DELPHI RELATED HYPOTHESIS

In testing the hypothesis, the Delphi technique was used as the methodology to collect expert opinion regarding consensus as to what teachers should know and what they should be able to do to effectively using library media centers, and Lorie's Measure of Ordinal Consensus used to test for possible consensus. The same procedures were used to determine what teacher educators should do in the next decade (1976-1986) in providing learning experiences for teachers and to determine if there may be identifiable and specifiable needs for the improvement of teacher education programs in teacher use of library media centers.

Hypothesis One

The null hypothesis "There is no consensus of national experts as to what teachers should know and what they should be able to do in effectively using library media centers" was rejected. In testing this hypothesis, twenty-five items were identified at seventy-five percent consensus or better, with seven items tested at absolute consensus. Only one item tested failed to achieve consensus of those related to hypothesis one. Although present technques have not been developed to test levels of significance, the first hypothesis was rejected by use of Leik's Measure of Ordinal Consensus which is a measure of the dispersion for ordinal data collected by the Delphi process. This seems to be appropriate in spite of the lack for determination of levels of significance since the level of defined consensus is twenty-five percent above the level accepted as consensus in the literature. Measures of variance are not appropriate unless the assumption of equal intervals on the scales used on the instruments can be accurately made. This is doubtful.

Hypothesis Two

The null hypothesis "There is no consensus of national experts as to what library media center learning experiences teacher educators should provide for future teachers" was rejected. In testing this hypothesis, twenty-four items were identified at the seventy-five percent level or better, with four items tested at absolute consensus. Only one item tested failed to achieve consensus. The lack of a suitable measure for significance was explained for hypothesis one and the same information and reasoning pertains to the rejection of this hypothesis.

Hypothesis Three

The null hypothesis "There is no identifiable and specifiable needs for the improvement of teacher education programs in terms of teacher use of library media centers" was evaluated on the basis of the testing of all fifty-eight Delphi items. The procedures have been previously explained in discussing the testing of hypothesis two and three. The same analysis of data accounts for the rejection of this hypothesis by the similar testing of the fifty-eight items, forty-five of which revealed defined consensus of seventy-five percent utilizing Leik's Measure of Ordinal Consensus, with eleven of the items tested at absolute consensus. Of the total fifty-eight items so tested, only two failed to meet defined consensus levels.

The analysis of the collected data provided the means to identify, test and specify fifty-eight items which express needs for the improvement of teacher education programs in terms of teacher use of library media centers. On this basis, a check-list was constructed as displayed in appendix E. It shows specified needs of teachers in using library media centers, ranked by the combined values assigned by the national panel of experts during the Delphi phase of the study, and thereby the third hypothesis is rejected.

Hypothesis Four

The hypothesis "Methodology which will test possible consensus may be successfully applied to the described problem for this study" was evaluated on the basis of the development of consensus. Of the fifty-eight items generated in the Delphi phase of the study, only two failed

to achieve consensus as rated by the national panel of experts, with both of those very near the defined consensus. Therefore, this fourth-hypothesis is supported.

TESTING FAULT TREE ANALYSIS RELATED HYPOTHESIS

The last questions stated as part of the hypothesis dealt with the methodology of combining Delphi-Fault Tree analysis as an effective needs assessment tool in national needs assessment projects. The last remaining questions of the hypothesis will be discussed in a unified presentation with the data of the FTA phase of the study since they are closely related and more effectively presented as a single feature of the study.

Hypothesis Five and Six

As related in the Methods and Procedures chapter three, two attempts were made to develop a means of collecting the FTA data by mail for the qualification phase of this study. The pilot groups made up of advanced graduate students of the IM Department and faculty were unable to work effectively through a simulated mailed questionnaire procedure. The funding of the study did not provide for the panel of experts to meet face to face in conference work. The Delphi-FTA process may indeed provide a means to make a national needs assessment, but the design of such a project must provide for the direct involvement of the panel members following the Delphi phase. This is best done by setting a conference meeting timed well ahead and have the panel meet "face to face" with the other members and the project director to quantify the tree, and to refine the qualification of the fault tree.

In the present study, a local panel of experts was utilized to quantify (rank the events) in the fault tree. The question presented as hypothesis five that "Delphi-Fault Tree Analysis (DEFT) may serve effectively as a needs assessment tool in national instructional development projects remains not fully answered, but it appears to the investigator that the potential is there. If the same effects occur with a national panel of experts as occured with the Department of Instructional Media faculty serving as the local panel, the hypothesis could be supported.

A faculty retreat is scheduled for September 14th and 15th, 1976, as a follow-up to the earlier mentioned retreat of June 24-25, 1976, for the purpose of further refining the "Master Resource Teacher" concept. The results of the present study will be input for the September retreat, which the quantification process helped to generate from the faculty meeting of July 16, 1976, which was used to quantify the fault tree for the present study.

As with the literature and the studies reported on FTA, there is a cynergistic effect from the process upon the participants. The effect upon the IM faculty at Utah State University is due in part to the participation in the NATUL project. It appears that DEFT (Delphi-Fault Tree Analysis may prove an effective tool for instructional development, but more research will nave to be done before the fifth hypothesis may be accepted.

The sixth hypothesis statement was that "DEFT may provide a more systematic means of projecting changing needs in American public and higher education." Using the two tools of Delphi and FTA in combination provides a means to analyze a system following the "success"

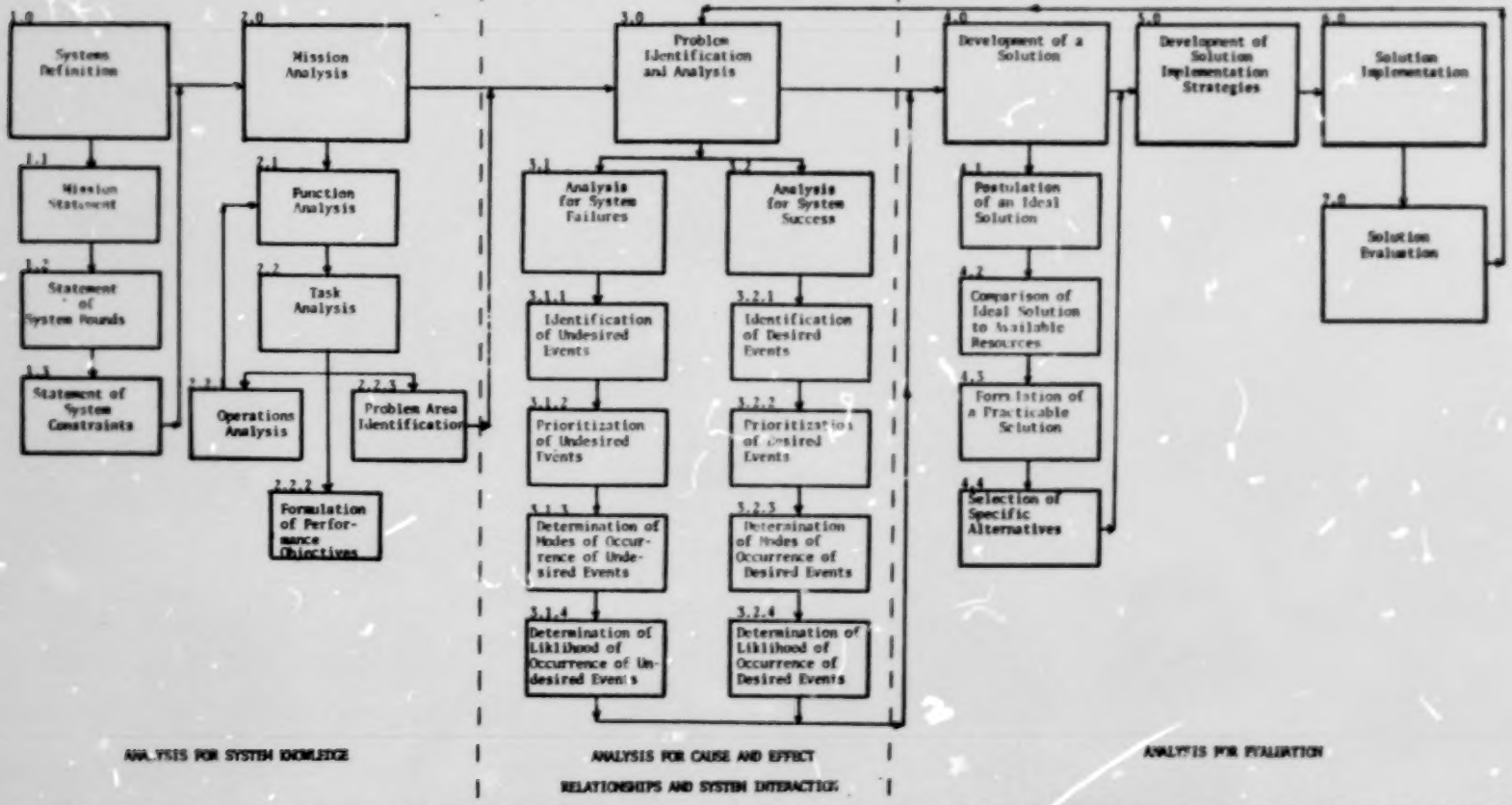
pattern, and then to make an analysis of the system under observation by analyzing possible modes of failure. The basis for testing hypothesis six was whether or not additional data might be generated and new decisions made which would be lacking by the traditional "success" analysis. Both of these "problem identification and analysis" patterns are graphically portrayed in figure 8, page 92, a chart with these treated in the center portion. The fifty-eight item checklist displayed in appendix E reflects the analysis of system success in the present study, while the fault tree displayed in appendicies G through M reveals the analysis of liklihood of occurrence of identified undesired events. New data was generated which adds to the national needs assessment from the fault tree analysis, and new decisions were made. The fact that an academic department of a university has taken upon the task of further development of the "Master Resource Teacher" concept which in part is the result of the present study lends further support to hypothesis six. Upon that basis, hypothesis six appears to the investigator to be supported, although some may question the validity on the basis of the use of the local panel as opposed to using a national panel.

SYSTEM FAILURES ANALYSIS OF TEACHER USE OF LIBRARY MEDIA CENTERS

The prime and two alternative prime strategic paths were identified by quantification of the fault tree created by the study. The prime systems failure event was identified as "failure to use people effectively," specifically media production specialists as reflected in table 4 on page 93. This was not identified or treated in the Delphi phase of the study, and is significant as new data. It should be noted that the production specialist does more than create materials.

Figure 8

Systems Analysis


1.0 Systems Definition
1.1 Mission Statement
1.2 Statement of System Bounds
1.3 Statement of System Constraints
2.0 Mission Analysis
2.1 Function Analysis
2.2 Task Analysis
2.2.1 Operations Analysis
2.2.2 Formulation of Performance Objectives
2.2.3 Problem Area Identification
3.0 Problem Identification and Analysis
3.1 Analysis for System Failures
3.1.1 Identification of Undesired Events
3.1.2 Prioritization of Undesired Events
3.1.3 Determination of Modes of Occurrence of Undesired Events
3.1.4 Determination of Likelihood of Occurrence of Undesired Events
3.2 Analysis for System Success
3.2.1 Identification of Desired Events
3.2.2 Prioritization of Desired Events
3.2.3 Determination of Modes of Occurrence of Desired Events
3.2.4 Determination of Likelihood of Occurrence of Desired Events
4.0 Development of a Solution
4.1 Postulation of an Ideal Solution
4.2 Comparison of Ideal Solution to Available Resources
4.3 Formulation of a Practicable Solution
4.4 Selection of Specific Alternatives
5.0 Development of Solution Implementation Strategies
6.0 Solution Implementation
7.0 Solution Evaluation
ANALYSIS FOR SYSTEM KNOWLEDGE
ANALYSIS FOR CAUSE AND EFFECT RELATIONSHIPS AND SYSTEM INTERACTION
ANALYSIS FOR EVALUATION

Source: Kent G. Stephens

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Table 4

Prime Strategic Path for Teacher Use of Library Media Centers

Events	Statements
UE	Failure of Mission: To Make Improvements in Teacher Use of Library Media Centers.
A	Failure of Mission because of inadequate use of existing learning resources.
AE	Inadequate use of existing learning resources because of failure to effectively use people.
AEA	Ineffective use of people because of failure to effectively use specialists.
AEAC	Ineffective use of specialists because of failure to effectively use media production specialists.*

*Production is defined as "to take specifications developed in the design function and to either create the resources, or if they already exist to locate them."

As the production function is defined in appendix A for scoping the fault tree, "production is to take the specifications developed in the design function and to either create the resources, or if they already exist, to locate them." The production specialist must of necessity created by this definition, provide what some librarians would define as a reference service. Because employment of production specialists as opposed to production technicians in library media centers is a relatively recent innovation, this holds special importance.

The first alternative prime strategic path identified personnel management, and specifically the "ineffective use of personnel development through use of inservice training" as displayed in table 5 on page 95. An intuitive guess might have been made that this would rate high as a mode of possible systems failure, but the FTA quantification confirms that fact. Inservice programs in use of library media centers is identified as essential.

The second alternative prime strategic path identified was the "inadequate use of learning resources development." The event specifically identified was "inadequate identification of learning objectives because of failure to identify the stage of learning objectives (prerequisite enabling or terminal objectives) as shown in table 6 on page 96. Although one may have guessed that objectives would be somewhere in the FTA strategic paths of a high order, the specificity and exactness of the identification is pinpointed by the FTA process. This finding supports further hypothesis six that suggests Delphi-Fault Tree Analysis used in combination lends to a more effective systematic means of needs assessment for instructional development and for projecting changing needs in American education.

Table 5

First Alternate Prime Strategic Path for Teacher Use of Library Media Centers

Events	Statements
14	Failure of Mission: To Make Improvements in Teacher Use of Library Media Centers.
8	Failure of Mission because of inadequate use of instructional management.*
BB	Inadequate use of instructional management because of failure to effectively use personnel management.
BBC	Ineffective use of personnel management because of failure to effectively use personnel development.
BBCB	Ineffective use of personnel development because of failure to use inservice training.

*Instructional Management is defined as "the coordination between various parts of a system to insure effective management."

Table 6

Second Alternate Probable Strategic Path for Teacher
Use of Library Media Centers

Events	Statements
UE	Failure of Mission: To Make Improvements in Teacher Use of Library Media Centers.
E	Failure of mission because of inadequate use of learning resources development.*
EB	Inadequate use of learning resources development because of failure to effectively use the design function.
EBC	Ineffective use of the design function because of failure to make needs assessment.
EBCA	Inadequate specification of learning objectives because of failure to identify stage of learning objectives (prerequisite, enabling or terminal objectives).

*Learning Resources Development is defined as "stressing the systematic approach to the total process of learning. It takes learning resources ideas from the research stage to the point of utilization. Learning resources are all ideas, human and non-human, which assist learners to assimilate information, attitudes and skills."

Branch 8, Use of Existing Learning Resources

Every field of intellectual activity utilizes resources of various types in contributing the process of achievement of its goals and objectives. In use of library media centers, the general field of activity in locating more generally identified as part of educational technology. In educational technology the resources are used to promote learning and include materials, devices, techniques, settings, content and staff. Branch 8 of the fault tree developed by the present study relates to using existing learning resources, with the first alternate strategic path leading to the critical event of "ineffective use of printed/pictorial materials because of failure to effectively use reference books (indexes, abstracts, etc.)). The second alternate strategic path for branch 8 led to "ineffective use of media with general technique because of failure to effectively use media with learners." For display, see pages 88 and 89.

Branch 9, Use of Instructional Management

Management is concerned with directing the activities of a system towards specified goals and objectives. The two principal management functions include organizational management and personnel management. Organizational management activities usually include the general regulation, direction and control of activities which are system wide and not confined to any one unit, subsystem, or other component. Personnel management generally includes the supervision and coordination of staff members within the system. Instructional management concepts are essential to educational technology as a system. Traditionally, decisions directly affecting instruction have been made on the classroom level. By focusing

Table 7

First Alternate Strategic Path for Branch A,

Use of Existing Learning Resources

Events	Statements
UE	Failure of Mission: To Make Improvements in Teacher Use of Library Media Centers.
A	Failure of mission because of inadequate use of existing learning resources.
AA	Inadequate use of existing learning resources because of failure to effectively use materials.*
AAD	Ineffective use of materials because of failure to effectively use printed/pictorial materials.
AADA	Ineffective use of printed/pictorial materials because of failure to effectively use reference books (indexes, abstracts, etc.).

*Materials are defined as "non-human learning resources which are used to store messages for instruction and which have direct interface with learners."

Table 8

Second Alternate Strategic Path for Branch A,

Use of Existing Learning Resources

Events	Statements
UE	Failure of Mission: To Make Improvements in Teacher Use of Library Media Centers.
A	Failure of mission because of inadequate use of existing learning resources.
AC	Inadequate use of existing learning resources because of failure to effectively use techniques.*
ACA	Ineffective use of techniques because of failure to effectively use of media with general techniques.
ACAA	Ineffective use of media with general techniques because of failure to effectively use media with lectures.

*Techniques are defined as "specific methods and modes for structuring and using materials, devices, settings, and people to carry a message."

upon instructional management, a "team approach" is taken which involves content experts, classroom teachers, curriculum and instructional developers, production specialists, among the many who share in the decision making effecting instruction and learning. By the "team approach" the teacher's role is not eliminated but changed and made potentially more effective. Branch B of the fault tree developed relates to using instructional management including organizational and personnel management.

The first critical failure event identified for branch B was "ineffective use of goals and policies because of failure to effectively use goals and policies about roles and purposes." The second critical failure event identified in branch B was "ineffective implementation of goals and objectives because of failure to plan for implementation." Branch B alternate strategic paths are displayed in figures 9 and 10 on pages 101 and 102.

Branch C, Use of Learning Resources Development

Educational technology focuses upon the systematic identification, development, organization, and utilization of a full range of learning resources to facilitate learning. The specific areas of learning resources development include research, design, production, evaluation, logistics, and utilization. This listing of areas reflects the wide scope of concerns within the field, and each of these areas may be directed to the learning resources. The area of learning resources development includes much more than the "physical creation" of instructional materials.

The first alternate strategic path for branch C led to the event of "failure to determine purposes of evaluation because of failure to determine evaluation for revision." The second alternate strategic path

Table 9

First Alternate Strategic Path for Branch B,

Use of Instructional Management

Events	Statements
UE	Failure of Mission: To Make Improvements in Teacher Use of Library Media Centers.
B	Failure of mission because of inadequate use of instructional management.
BA	Inadequate use of instructional management because of failure to effectively use organizational management.*
BAA	Ineffective use of organizational management because of failure to effectively use goals and policies.
BAAA	Ineffective use of goals and policies because of failure to effectively use goals and policies about roles and purposes.

*Organizational management is defined as "to determine, modify, or implement the objectives, philosophy, policy, structure, budget, internal or external administrative procedures of an organization or institution performing learning resources development and utilization."

Table 10

Second Alternate Strategic Path for Branch C,
Use of Instructional Management

Events	Statements
UE	Failure of Mission: To Make Improvements in Teacher Use of Library Media Centers.
B	Failure of mission because of inadeqaute use of instructional management.
BA	Inadequate use of instructional management because of failure to effectively use organizational management.*
BAB	Ineffective use of organizational management because of failure to effectively implement goals and policies.
BABA	Ineffective implementation of goals and objectives because of failure to plan for implementation.

*Organizational management is defined as "to determine, modify, or implement the objectives, philosophy, policy, structure, budget, internal or external administrative procedures of an organization or institution performing learning resources development and utilization."

identified for Branch C was "ineffective use of utilization function because of failure to select appropriate materials matching learning resources to learners and objectives." Tables 11 and 12 show the relationships of these events to the failure of the mission statement, and are displayed on pages 104 and 105.

SUMMARY

Professional educators from Colleges of Education, Library Schools, practitioners from the field, specialists from departments of public instruction and professional organizations comprised the national panel of thirty-six experts used in the study. A local panel of eight experts made up of instructional media and library science specialists was used to quantify the fault tree developed from the input of the national panel and the literature.

Three rounds of questionnaires were used in completing the Delphi phase of the study as by then a consensus had been reached for fifty-six of the fifty-eight items generated in the Delphi process. There was a ninety-seven percent return on the first Delphi round with eighty-three percent returns on the remaining rounds. These high returns were atributed to the fact each national panel member was paid a small honorarium provided through a grant made to the investigator for the NATUL project.

Leik's Measure of Ordinal Consensus was used to determine the consensus in terms of a ratio and was then appropriately displayed by percentage. The fifty-eight items developed from the Delphi phase were ranked and used to generate a check list for teacher use of library media centers.

Table 11

First Alternate Strategic Path for Branch C, Use of Learning Resources Development

Events	Statements
UE	Failure of Mission: To Make Improvements in Teacher Use of Library Media Centers.
C	Failure of mission because of inadequate use of learning resources development.
CD	Inadequate use of learning resources development because of failure to effectively use the evaluation function.*
CDB	Ineffective use of evaluation function because of failure to determine purposes of evaluation.
CDBA	Failure to determine purposes of evaluation because of failure to determine evaluation for revision.

*Evaluation is defined as "to assess the acceptability and suitability of learning resources according to specific criteria for the purpose of making decisions about such resources and their use."

Table 12

Second Alternate Strategic Path for Branch C,

Use of Learning Resources Development

Events	Statements
UE	Failure of Mission: To Make Improvements in Teacher Use of Library Media Centers.
C	Failure of mission because of inadequate use of learning resources development.
CE	Inadequate use of learning resources development because of failure to effectively use the utilization function.*
CEA	Ineffective use of the utilization function because of failure to select appropriate materials matching learning resources to learners and objectives.

*Utilization is defined "to structure and bring about the actual contact between learners and learning resources."

A fault tree of 309 events was developed from the inputs from the national panel of experts and the literature, and then quantified with the assistance of a local panel of experts from the Utah State University Department of Instructional Media. The data collected in the FTA phase of the study was processed through the computer program FTAP on file at Brigham Young University Computer Center.

The prime strategic path of the fault tree identified the "ineffective use of people, specifically media production specialists." Media production was defined as more than the mere creation of learning resources, but taking "the specifications developed in the design function and to either create the resources, or if they already exist to locate them." This entails some of the reference services function traditionally performed by librarians. The first alternate strategic path led to the failure event of "ineffective use of personnel development because of failure to effectively use inservice training," with the second alternate path leading to "inadequate specifications of learning objectives because of failure to identify stages of learning objectives (prerequisite, enabling or terminal objectives).

Two alternate paths were determined for Branch A, Using Existing Learning Resources, Branch B, Using Instructional Management, and Branch C, Using Learning Resources Development.

Chapter 5

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

PURPOSES

The major purpose of this study was to discover a possible consensus of expert opinions as related to teacher use of library media centers in American public education. The study included the following subsumed purposes:

1. To analyze required teacher skills and knowledge as suggested by the experts through a systematic methodology.
2. To suggest a basis for future instructional development for teachers learning to utilize library media centers effectively as a prime tool of the teaching-learning process.
3. To provide a needs assessment to determine what exists (the status quo) and what should be (the ideal situation) and the difference between what is and what should be by the systematic gathering of expert opinions.

Hypothesis

The hypothesis developed for the study were stated as:

1. There is no consensus of national experts as to what teachers should know and what they should be able to do in effectively using library media centers.
2. There is no consensus of national experts as to what library

media center experiences teacher educators should provide for future teachers.

3. There are no identifiable and specifiable needs for the improvement of teacher education programs in terms of teacher use of library media centers.
4. Methodology which will test possible consensus may be successfully applied to the described problem of this study.
5. Delphi-Fault Tree Analysis (DEFT) may serve effectively as a needs assessment tool in national instructional development projects.
6. DEFT may provide a more systematic means of projecting changing needs in American public and higher education in the future.

Delimitation

The study was limited to the responses of a thirty-six member panel of experts selected so as to represent a cross section of library media specialists as nominated by Deans and Directors of nationally accredited schools and colleges of education and library schools, along with nominations from state departments of public instruction, and be geographically distributed across the United States. In addition a local panel of experts made up of eight faculty members of the Utah State University Department of Instructional Media, was used to quantify the fault tree developed through the study.

METHODS

The study utilized Delphi methodology in combination with Fault Tree Analysis. The study was planned, developed and completed over a period of more than two years. The national panel of experts was paid an honorarium of $25.00 each for their efforts in the project which was titled the NATUL Project (National Needs Assessment of Teacher Use of Library Media Centers). The funds for the study in part were provided by a grant provided to the investigator based upon a proposal written to the Utah State University Bureau of Educational Research Services, the Research Committee of the USU College of Education and the Utah State University Development fund.

SUMMARY OF FINDINGS

The analysis of the data collected provided the following findings:

1. A consensus of national experts concerning effective use of teacher use of library media centers was discovered.
2. A consensus of national experts concerning what learning experiences should be provided by teacher educators was also discovered.
3. Specific needs for the improvement of teacher education programs in terms of teacher use of library media centers were developed as a checklist of fifty-eight items and nine identified critical events which may cause systems failure. These findings suggest a specific basis for future instructional development.

4. Delphi-fault tree analysis was successfully applied to the problem of the study as a needs assessment tool.
5. DEFT (Delphi-fault tree analysis) methodology as a tool in national needs assessment projects appears to the investigator to be effective, but more research is needed to confirm this observation. Cost inhibited the full testing of DEFT methodology utilizing the national panel on a "face to face" basis. The local panel of experts was used in the last phase of the study in place of a national panel of experts.
6. DEFT provides a more systematic means of projecting changing needs in American education by providing analysis of both system success and possible system failures. Different data was generated by each phase of the study supporting the use of DEFT. As suggested in the review of FTA literature, analysis of possible failures was not the reciprocal of analysis for system success.

SUMMARY OF PROCESS

The procedures related to this study included the following activities:

1. The selection of the national panel of experts. It was was estimated that the panel members expended two hundred and eighty-eight man hours of time with the study. Total cost for this time was $900.00.
2. The selection and preparation of the national experts for the study required considerable correspondence and time. The

cost for this process was estimated at $120.00, exclusive of the time of the investigator which was not accurately recorded.

5. The generation of the Delphi instruments utilized in the study required approximately eighty-one hours of time to be expended by the investigator, with an additional forty-seven hours required for analyzing the Delphi data.

6. The analysis of the data generated by the Delphi phase of the study and the review of literature specifically for input to the fault tree qualification required an additional seventy-five hours of the researcher's time.

7. The local panel of experts expended more than sixty-seven man hours of time in the quantification (ranking) of the fault trees. The low amount of time required of the local panel was made possible by precoding the FTA data collection forms and providing comfortable working quarters for the the local panel. The local panel donated their time to the project.

8. The data comprised of the rankings of failure events was keypunched directly from the completed precoded FTA data collection forms and run through the Brigham Young University Computer Center using the FTAP program on file there. The cost for the computer analysis was slightly less than $150.00.

The total DDTIS project required an estimated five hundred and sixty-one hours excluding the initial review of the literature and writing of reports and proposals. The total cost for the project, including the investigator's time was estimated at more than $9,000.

CONCLUSIONS

The following conclusions are based upon the experience with the NATUL project:

1. The estimate of time constraints for Delphi studies are very conservative in the early literature. A Delphi study of this magnitude will require at a minimum more than one year to complete.
2. The combination of Delphi and Fault Tree Analysis appears useful for national needs assessment projects. DEFT provides a more systematic means of making needs assessment.
3. The teacher in large part determines the effective use of the library media center by students. The national trend of including a media center in every school suggests more attention should be given to using LMC's in teacher education curriculum.
4. A cynergistic force is created in the FTA process which has a positive effect upon those involved in the process, such as the committment by the USU IM Department faculty to develop further the "Master Resources Teacher" concept.
5. When expert panels are employed to generate data, they will be more effective if paid even a token amount as was suggested to be done in the literature, and was done in this study. The high response of the national panel is credited to the procedures used and the payments made to each.

RECOMMENDATIONS

Recommendations are based upon the NATUL project are:

1. Because clearly stated goals and objectives for teacher education in terms of library media center use have been lacking, it is recommended that teacher educators use the generated checklist and FTA findings of the NATUL Project to apply directly to local instructional development procedures, or that they be used as a beginning point for conducting local needs assessments.
2. Fault Tree Analysis should be used more widely as a tool for instructional development because of the cynergism and positive effect the activities may have upon participants. FTA is further recommended as a needs assessment tool because of the additional data generated for more effective decision making.
3. The NATUL project should be replicated by other institutions or groups concerned with improving teacher use of library media centers. This may be done on a state or regional basis to develop local concerns for teacher education curricula.
4. The provision of a learning package, based upon the NATUL project should be undertaken. The investigator plans to solicit funds to carry on the project so as to make such a program more widely available.
5. Teacher education institutions should consider the creation of "Master Resources Teacher" programs based on the NATUL project, if the full implications of the study are to be made.

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BIBLIOGRAPHY

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Mr. Thomas Boisvert, Instructor and Stockroom Manager, Instructional Media, Technical Media Management and Production Specialist

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APPENDIX C

DELPHI QUESTIONNAIRE ONE

APPENDIX C
DELPHI QUESTIONNAIRE ONE

TEACHER USE OF LIBRARY MEDIA CENTERS IN THE FUTURE

When you respond to the questions below, think in terms of what conditions are likely to be present during the decade 1975 to 1985, and what the results of Teacher Education ought to be in view of THESE CONDITIONS AS RELATED TO USE OF LIBRARY MEDIA CENTERS. Specific statements will be more helpful than general ones.

AS A RESULT OF THE EXPERIENCES PROVIDED BY TEACHER EDUCATION, FUTURE TEACHERS SHOULD:

Know _____

_____

_____

Be able to _____

_____

_____

Feel _____

_____

_____

FORMAL TEACHER EDUCATION SHOULD:

Increase _____

_____

Maintain _____

_____

Reduce _____

_____

Develop _____

_____

(Attach additional pages if needed)

Return to: R. Kent Wood
Utah State University
UMC # 30
Logan, Utah 84322

___ ___ ___ ____ Soc. Sec #
(for coding purposes only)

APPENDIX D

DELPHI QUESTIONNAIRE TWO

APPENDIX D

DELPHI QUESTIONNAIRE TWO

TEACHER USE OF LIBRARY MEDIA CENTERS IN THE FUTURE

When you respond to the questions below, consider what conditions are likely to be present during the decade 1976 to 1986 and what the results of TEACHER EDUCATION ought to be in view of THESE CONDITIONS AS RELATED TO USE OF LIBRARY MEDIA CENTERS.

PLEASE CIRLCE YOUR PRIORITY FOR EACH ITEM

AS A RESULT OF THE EXPERIENCES PROVIDED BY TEACHER EDUCATION, FUTURE TEACHERS SHOULD KNOW:

	Priority Low High	
1.	1 2 3 4 5 6	the characteristics, functions and services of a library media center as contrasted with the traditional predominantly print library.
2.	1 2 3 4 5 6	how to use standard, authoritative sources of information such as indexes, bibliographies, biographical sources, encylopedias, yearbooks, abstracts and other such materials.
3.	1 2 3 4 5 6	how to use standard, authoritative sources of media software programs (such as NICEM Indexes, Westinghouse Learning Materials Directory, Standard Catalog Series, Bro-Dart Catalog of Instructional materials, University Film Catalogs and other such materials) for selection, purchase and rental.
4.	1 2 3 4 5 6	basic communications theory and how it may be applied to media use.
5.	1 2 3 4 5 6	how learning theory and curriculum alternatives may relate to effective use of media centers.
6.	1 2 3 4 5 6	the unique and specific values of all classes of media, such as books, films, ETV, games, simulations, among the many, as they relate to the teaching-learning process.
7.	1 2 3 4 5 6	the value of visual literacy processes as an aspect of communications.
8.	1 2 3 4 5 6	a general overview of children's and young adult literature.

	Priority Low High	
9.	1 2 3 4 5 6	how to determine grade levels and interests for children and young adult media programs.
10.	1 2 3 4 5 6	what one role of the media specialist is as it pertains to production, instructional development, provision of materials and guidance in the use of library media centers.

AS A RESULT OF THE EXPERIENCES PROVIDED BY TEACHER EDUCATION, FUTURE TEACHERS SHOULD BE ABLE TO:

	Priority Low High	
11.	1 2 3 4 5 6	work as part of an instructional team in achieving instructional goals and objectives.
12.	1 2 3 4 5 6	use specialized media personnel to support instruction.
13.	1 2 3 4 5 6	teach students basic information retrieval skills and sources including card catalogs, printed book catalogs, indexes, bibliographies, biographical sources, dictionaries, encyclopedias, yearbooks, gazetters, review services, among the several.
14.	1 2 3 4 5 6	guide and motivate students in use of library media centers such as viewing, listening and reading activities.
15.	1 2 3 4 5 6	use inquiry methods (learning how to find out, how to synthesize and encourage creativity) through use of media centers.
16.	1 2 3 4 5 6	assume the leadership role in using library media centers to develop effective learning experiences for students.
17.	1 2 3 4 5 6	plan, organize and use appropriate media, equipment technologies and personnel to allow students to take more responsibility for their own learning.
18.	1 2 3 4 5 6	develop learning objectives which take into account individual differences and individualize instruction through the use of single and mixed media.
19.	1 2 3 4 5 6	individualize instruction through use of computer assisted instruction.

	Priority Low	High	
20.	1 2 3 4 5 6		integrate and utilize the resources, equipment and services of library media center programs to support classroom instruction and learning.
21.	1 2 3 4 5 6		utilize mass media (TV, radio, newspapers and periodicals) effectively in the instructional process.
22.	1 2 3 4 5 6		assist in the selection of materials for library media centers.
23.	1 2 3 4 5 6		analyze and evaluate commercially produced materials for effectiveness to accomplish specific learning objectives.
24.	1 2 3 4 5 6		operate standard media equipment, such as projectors, recorders and playback units.
25.	1 2 3 4 5 6		trouble shoot minor equipment problems to repair or remedy the identified malfunctions.
26.	1 2 3 4 5 6		produce basic instructional materials such as simple programmed texts, slides, 8mm films, transparencies, audio and video tapes.
27.	1 2 3 4 5 6		select and/or produce materials which reduce antagonisms toward groups, races, sexes, and religions.
28.	1 2 3 4 5 6		guide students in the production of basic instructional materials such as slides, films, transparencies, audio and video tapes.
29.	1 2 3 4 5 6		use a systems approach to media use, by identifying learner needs, developing sequences for media use, and testing the results so as to validate or revise materials for future use.
30.	1 2 3 4 5 6		explain why no type of media may replace them as teachers, but only change their traditional role in dispensing information.
31.	1 2 3 4 5 6		function as instructional managers in using media centers.
32.	1 2 3 4 5 6		manage selected activities, such as "peer tutoring" in library media centers.
33.	1 2 3 4 5 6		plan their own continuous study and self evaluation for professional growth through the use of media centers.

DURING THE DECADE 1976 - 1986 FUTURE TEACHER EDUCATORS SHOULD:

	Priority Low					High	
34.	1	2	3	4	5	6	individualize undergraduate teacher education programs.
35.	1	2	3	4	5	6	analyze changes in social values and concerns and the impact on use of library media centers.
36.	1	2	3	4	5	6	develop more support for the development of library media programs.
37.	1	2	3	4	5	6	use library media centers as important resources in the development of new methods and ideas in education.
38.	1	2	3	4	5	6	increase supportive staff for Professors of Education for preparing and retrieving instructional materials for teacher education.
39.	1	2	3	4	5	6	humanize teaching-learning processes in teacher education by providing appropriate modeling strategies which free students to learn at their own levels and rates from well conceived media experiences.
40.	1	2	3	4	5	6	develop more effective ways for incorporating the use of library media centers into teacher education curricula.
41.	1	2	3	4	5	6	select cooperating teachers who effectively use media.
42.	1	2	3	4	5	6	provide exposure to exemplary media centers in teacher education so student teachers may use them in any or all of their education classes and student teaching.
43.	1	2	3	4	5	6	emphasize the notion that education and learning is a life-long process supported by use of library media centers.
44.	1	2	3	4	5	6	provide more simulated teaching experiences using media.
45.	1	2	3	4	5	6	provide competency-based course work to improve instruction through use of instructional media.
46.	1	2	3	4	5	6	increase emphasis on teaching of reading and communications skills.

[illegible] THE DECADE 1970 - 1980 FUTURE TEACHER EDUCATION SHOULD:

	Priority Low				High	
47.	1	2	3	4	5	6	provide a general education for student teachers in a wide variety of disciplines and cross-disciplinary learning situations using media.
48.	1	2	3	4	5	6	emphasize subject and fact mastery.
49.	1	2	3	4	5	6	provide methods courses which demonstrate effective teaching-learning techniques using media as alternatives to lectures.
50.	1	2	3	4	5	6	develop units in educational preparation courses that help students integrate media with concept development.
51.	1	2	3	4	5	6	increase instruction and laboratory work in producing instructional materials.
52.	1	2	3	4	5	6	increase instruction and laboratory work in use of media equipment.
53.	1	2	3	4	5	6	increase formal course work for teachers in use library media centers in the teaching-learning process.
54.	1	2	3	4	5	6	develop experimental learning resource problem development centers (learning resources laboratories) where new forms and new applications of media may be developed and evaluated.
55.	1	2	3	4	5	6	emphasize book-centered learning and self-contained classrooms.
56.	1	2	3	4	5	6	develop a philosophy of education that encompasses all students and their use of library media centers.
57.	1	2	3	4	5	6	develop content in post training (after graduation) for further improved media utilization in continuing inservice programs.
58.	1	2	3	4	5	6	develop a better integration of media in present programs by utilizing professors of media and library as consultants in curriculum structure and course planning for teacher education.

COMMENTS:

[redacted]

[redacted]

CHECKLIST OF TEACHER USE OF LIBRARY MEDIA CENTERS

PART I. TEACHERS

As the result of the experiences provided by teacher education, future teachers should:

1. be able to work as part of an instructional team in achieving instructional goals and objectives.
2. be able to use inquiry methods (learning how to find out, how to synthesize and encourage creativity) through use of media centers.
3. be able to guide and motivate students in use of library media centers such as viewing, listening and reading activities.
4. be able to plan, organize and use appropriate media, equipment, technologies and personnel to allow students to take more responsibility for their own learning.
5. know how learning theory and curriculum alternatives may relate to effective use of library media centers.
6. know the characteristics, functions and services of a library media center as contrasted with the traditional predominantly print library.
7. be able to develop learning objectives which take into account individual differences and individualize instruction through the use of single or mixed media.
8. know the unique and specific values of all classes of media, such as books, films, ETV, games, simulations, among the many, as they relate to the teaching learning process.
9. know how to use specialized media personnel to support instruction.
10. be able to assist in the selection of materials for library media centers.
11. what one role of the media specialist is as it pertains to production, instructional development, provision of materials and guidance in the use of library media centers.
12. know how to use standard, authoritative sources of information such as indexes, bibliographies, biographical sources, encyclopedias, yearbooks, abstracts and other such materials.
13. be able to assume the leadership role in using library media centers to develop effective learning experiences for students.
14. be able to operate standard media equipment, such as projectors, recorders, and playback units.
15. know basic communications theory and how it may be applied to media use.

16. be able to analyze and evaluate commercially produced materials for effectiveness to accomplish specific learning objectives.

17. be able to function as instructional managers in using media centers.

18. know how to use standard, authoritative sources of media software programs (such as NICEM Indexes, Westinghouse Learning Materials Directory, Standard Catalog Serices, Bro-Dart Catalog of Instructional Materials, University Film Catalogs and other such materials sources) for selection, purchase and rental.

19. be able to use a systems approach to media use, by identifying learner needs, developing sequences of media use, and testing the results so as to validate or revise materials for future use.

20. be able to plan their own continuous study and self evaluation for professional growth through use of media centers.

21. know a general overview of children's and young adult literature.

22. be able to explain why no type of media may replace them as teachers, but only change their traditional role in dispensing information.

23. be able to teach students basic information retrieval skills and sources including card catalogs, printed book catalogs, indexes, bibliographies, biographical sources, dictionaries, encyclopedias, yearbooks, gazetteers, review services, among the several.

24. be able to utilize mass media (TV, radio, newspapers and periodicals) effectively in the instructional process.

25. be able to select and/or product materials which reduce antagonisms toward groups, races, sexes, and religions.

26. know how to determine grade levels and interests for children and young adult programs.

27. be able to integrate and utilize the resources, equipment and services of library media center programs to support classroom instruction and learning.

28. know the value of visual literacy processes as an aspect of communications.

29. be able to produce basic instructional materials, such as simple programmed texts, slides, 8 mm films, transparencies audio and video tapes.

30. be able to guide students in the production of basic instructional materials, such as slides, films, transparencies, audio and video tapes.

31. be able to manage selected activities, such as "peer tutoring" in library media centers.

32. be able to individualize instruction through use of computer assisted instruction.

33. be able to trouble shoot minor equipment problems to repair or remedy the identified malfunctions.

PART II. TEACHER EDUCATORS
During the decade 1976-1986 Future Teacher Educators Should:

---

1. develop more effective ways for incorporating the use of library media centers into teacher education curricula.

2. use library media centers as important resources in the development of new methods and ideas in education.

3. provide exposure to exemplary media centers in teacher education so student teachers may use them in any or all of their education classes and student teaching.

4. develop more support for the development of library media programs.

5. select cooperating teachers who effectively use media.

6. emphasize the notion that education and learning is a life-long process supported by use of library media centers.

7. develop a better integration of media in present programs by utilizing professors of media and library as consultants in curriculum structure and course planning for teacher education.

8. provide methods courses which demonstrate effective teaching-learning techniques using media as alternatives to lectures.

9. increase emphasis on teaching of reading and communication skills.

10. develop units in educational preparation courses that help students integrate media with concept development.

11. provide more simulated teaching experiences using media.

12. develop a philosophy of education that encompasses all students and their use of library media centers.

13. develop contact in post training (after graduation) for further improved media utilization (a continuing inservice program).

14. humanize teaching-learning processes in teacher education by providing appropriate modeling strategies which free students to learn at their own levels and rates from well conceived media experiences.

15. increase supportive staff for Professors of Education for preparing and retrieving instructional materials for teacher education.

16. analyze changes in social values and concerns and the impact on use of library media centers.

17. provide a general education for student teachers in a wide variety of disciplines and transdisciplinary learning situations using media.

18. increase formal coursework for teachers to use library media centers in the teaching learning process.

19. individualize undergraduate teacher education programs.

20. provide competency-based course work to improve instruction through use of instructional media.

21. develop experimental learning resource product development centers (learning resources laboratories) where new forms and new applications of media may be developed and evaluated.

22. increase instruction and laboratory work in producing instructional materials.

23. increase instruction and laboratory work in use of media equipment.

24. de-emphasize subject and fact mastery.

25. de-emphasize book-centered learning and self-contained classrooms.

APPENDIX F

QUANTIFICATION INSTRUCTIONS AND SAMPLE FORM FOR FTA

FAULT TREE ANALYSIS FOR TEACHER USE OF LIBRARY/MEDIA CENTERS

The attached forms (13 in number of pages) list by Alpha-name 309 events identified by initial imput from a national panel of experts into catagories suggested by Educational Technology: A Guide to Standard Terminology of Educational Technology for Collecting and Recording Information. You may wish to consult it for definitions of any terms used in the Fault Tree events. The forms have been developed to simplify and stream-line the collection of this data. For examples to save time (your time) some of the events are grouped into sizes of up to ten in related areas, rather than the groupings of twos, threes, fours and fives as have been done with FTA in the past. Because of teh high level of expertise of your panel members in Instructional Media and Educational Technology this was felt best. The next two pages describe the Fault Tree Analysis Technology briefly if you wish more information, but it is not necessary for you to complete the assigned task of quantifying the fault tree on the wall of the room.

INSTRUCTIONS:

Inspect the fault tree and note each event has been given an alpha-name which corresponds to the event names listed on the forms. For each grouping of events rank them in order with 1 being ranked as the most likely event to cause failure in effective use of library media centers by teachers. For example, events A, B and C will be ranked together as related to the UE (undesired event or mission failure- the appex of the Fault Tree). If you feel event C contributes most to the possible failure of teacher use of library media centers, rank it 1, then the next event 2, and the other 3.

Next, estimate the approximate percentages of contribution of events listed to the possible failure. If you listed C as 1, you feel it contributes 50% of the possibilities of failure compared to B and C events, so mark it. Then divide up the remaining 50% so that the total percentage for the groups will be 100%. DON'T BE OVERLY CONCERNED WITH THE EXACT PERCENTAGE ESTIMATE. IT IS A RATION (ORDINAL DATA) AND PERCENTAGE POINTS ARE ONLY APPROXIMATE. GO BY FIRST IMPRESSIONS AND DON'T DELIBERATE FOR LONG PERIODS OF TIME TO MAKE YOUR ESTIMATES. This is listed under RELATIVE CONTRIBUTIONS on the forms.

Next, circle the letter which indicates your feelings about your confidence in your rankings as S (strong), M (moderate) or W (weak). This column is listed under CONFIDENCE.

For the "D" events (D listed in the event type column) additional markings are needed. Circle F if you feel the event you are ranking will occur frequently, P if you feel the event happens periodically, and R is circled if you feel the event happens rarely. This column is under FREQUENCY.

Under the last column RECTIFICATION estimate the degree of ease in correcting the event circling P for events which cannot be corrected (pornanent),

M for events you feel could be corrected with moderate ease, and E will be circled for events you feel may be corrected easily.

That's all there is to the task. Work as rapidly as you can and do not feel you must take long periods to think through the relationships. React to your first impressions as this will be more accurate of reality than those you spend a great deal of time with and read into the events much more than may be necessary.

THANKS FOR YOUR HELP AND HELP YOURSELVES TO REFRESHMENTS AT ANYTIME AS YOU WORK.

FAULT TREE ANALYSIS

Definition:

Fault Tree Analysis (FTA) is a technique for increasing the probability of success in any system by analyzing the most likely modes of failure that could occur.

A fault tree provides a logical, step by step description of the various combination of occurrences of events within a system which could result in failure of the system. The objective is to isolate and identify possible failure modes and thereby avoid them.

History:

In 1961 the concept of FTA was orginated by scientists at Bell Telephone Laboratories to evaluate the saftey of the minuteman launch control system. A team of analysts at the Boeing Company later modified the fault tree technique so that events in the analysis could be ranked and quantified. Kent G. Stephens was a member of the Boeing team who helped in this development. Dr. Stephens, presently an associate professor of education at BYU, has since adapted and modified FTA as a viable tool for use in analysis of human systems and within the educational community is recognized as the "father of fault tree analysis."

Steps in Fault Tree Construction & Analysis:

Basically four steps are present in a fault tree analysis:

1. System definition.
2. Fault tree construction.
3. Qualitative evaluation.
4. Quantitative evaluation.

System Definition:

System's definition essentially entails formulating the exact problem to be analyzed. System's definition should specifically state the system's goals and/or objectives, then break down the necessary components (functions) needed to achieve the system goal. The functions are in turn broken down into smaller components (tasks).

The system's definition, when properly broken down with an explanation of the major objectives and means of accomplishment become known as the mission analysis.

Fault Tree Construction:

To begin fault tree construction, one carefully considers the mission analysis to determine the major event which could cause the mission to fail. Identification of this event becomes known as the undesired event (UE). From here the construction of the tree begins by identifying these events yet further. There is no hard set rule as to how an event can or should be broken down. Generally speaking, each event should be carried down to a level where cause and effect relationships occur. Usually, the first three levels of the tree are the policy levels.

Qualitative Evaluation:

This involves the sketching or drawing of the entire tree to its completion and then validating the tree to ascertain the correct relationship of events to one-another. The sketching of the first three levels of the tree is known as "scoping the tree." Development beyond this level completes fault tree construction.

Quantitative Evaluation:

Quantitative evaluation involves the ranking of events against each other in order to determine priorities. Quantification is achieved via a modified Delphi technique. Once ranked, events are rated against each other and the application of the rules of Boolean Algebra are applied which results in the identification of a "critical path."

Formulating Recommendations:

Through the drawing of a fault tree and its analysis an individual or team of experts can easily identify areas in which special care and emphasis should be given within a system in order to better insure success. If the analysis is made during the design of a new program, the decisions based on the tree could either confirm original feelings or lead to design changes.

FTA aids in answering the question, "Why" a system fails or might fail.

FAULT TREE QUANTIFICATION FORM

PAGE___OF___

RATER'S INITIALS

EVENT NAME 1 10	EVENT TYPE[1] 19	GATE[2] 20	BASIC 21	RELATIVE CONTRIBUTION 24 25	OCCURRENCE 26			PROBABILITY[3] 28			PASSIVATION[3] 31		
					S	M	W	F	P	R	P	D	E
					S	M	W	F	P	R	P	D	E
					S	M	W	F	P	R	P	D	E
					S	M	W	F	P	R	P	D	E
					S	M	W	F	P	R	P	D	E
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					S	M	W	F	P	R	P	D	E
					S	M	W	F	P	R	P	D	E

1. TYPES OF EVENTS ARE:
   B-RECTANGLE
   D-DIAMOND

2. FOR RECTANGLE EVENTS ONLY.
   A-AND
   O-OR
   I-INHIBIT

3. FREQUENCY AND PASSIVATION ARE NOT INDEED FOR RECTANGLE EVENTS.

APPENDIX C

FAULT TREE SCHEMATIC OF UNDESIRED EVENTS AND BRANCHES GIVEN THROUGH LEVEL TWO EVENTS WITH DEFINITIONS OF LABELS

Definitions of Labels
Used for Scope of Tasks Task
Through Level Two

0 [illegible] RESOURCES are all those skills which learners to assimilate information, attitudes and skills.

1A MATERIALS are non-human learning resource skills are used to store messages for instruction and which have direct interface with learners.

1B DEVICES are items of equipment or implements used for display or transmission of instructional materials.

1C TECHNIQUES are specific methods and modes for structuring and using materials, devices, settings, and people to carry a message.

1D SETTINGS are locations either designed for instruction or locations where instruction can take place.

1E PEOPLE are those humans who transmit messages (or be materials) to learners in order to facilitate instruction and learning.

1F CONTENT is the messages to be learned.

2 INSTRUCTIONAL MANAGEMENT

is the coordination between various parts of a system to assure effectiveness of total effort.

2A ORGANIZATIONAL MANAGEMENT is to determine, modify, or implement the objectives, philosophy, policy, structure, budget, internal or external administrative procedures of an organization or institution performing learning resource development and utilization.

2B PERSONNEL MANAGEMENT is to interact with and/or to supervise personnel who perform activities in learning resources development and utilization.

3 [illegible] RESEARCH DEVELOPMENT increases the scientific approach to the total process of learning. It takes learning resource ideas from the research stage to the point of actual utilization.

3A RESEARCH is to generate and test knowledge related to various learning resources and their effects upon learners.

3B DESIGN is to draw upon research about learning, the learner, and learning resources and to write specifications for tools & resources and their use.

DEFINITIONS OF LABELS CONTINUED

CC PRODUCTION is to take the specifications developed in the design function and to either create the resources, or if they already exist to locate them.

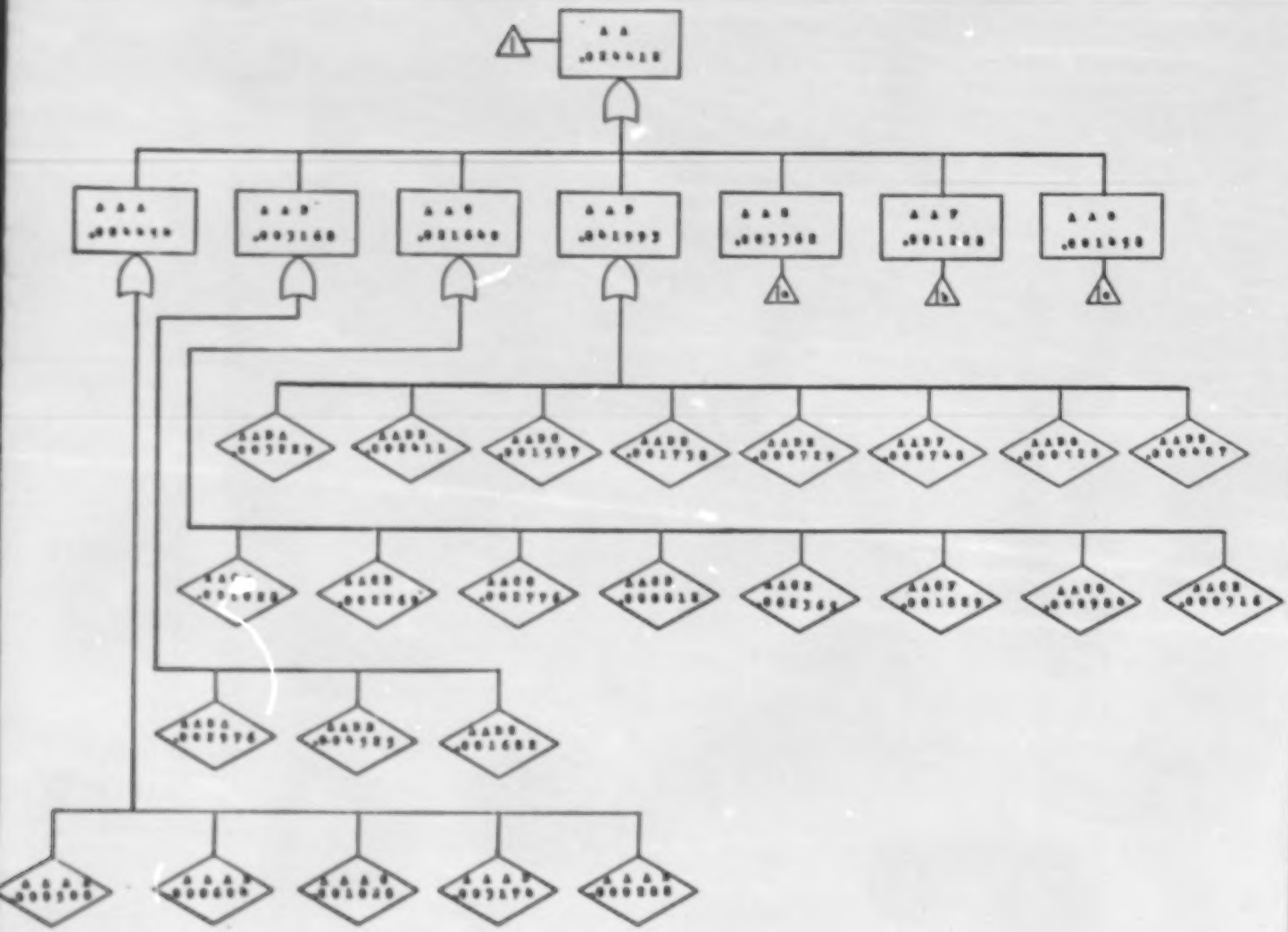
CD EVALUATION is to assess the acceptability and suitability of learning resources according to specific criteria for the purpose of making decisions about such resources and their use.

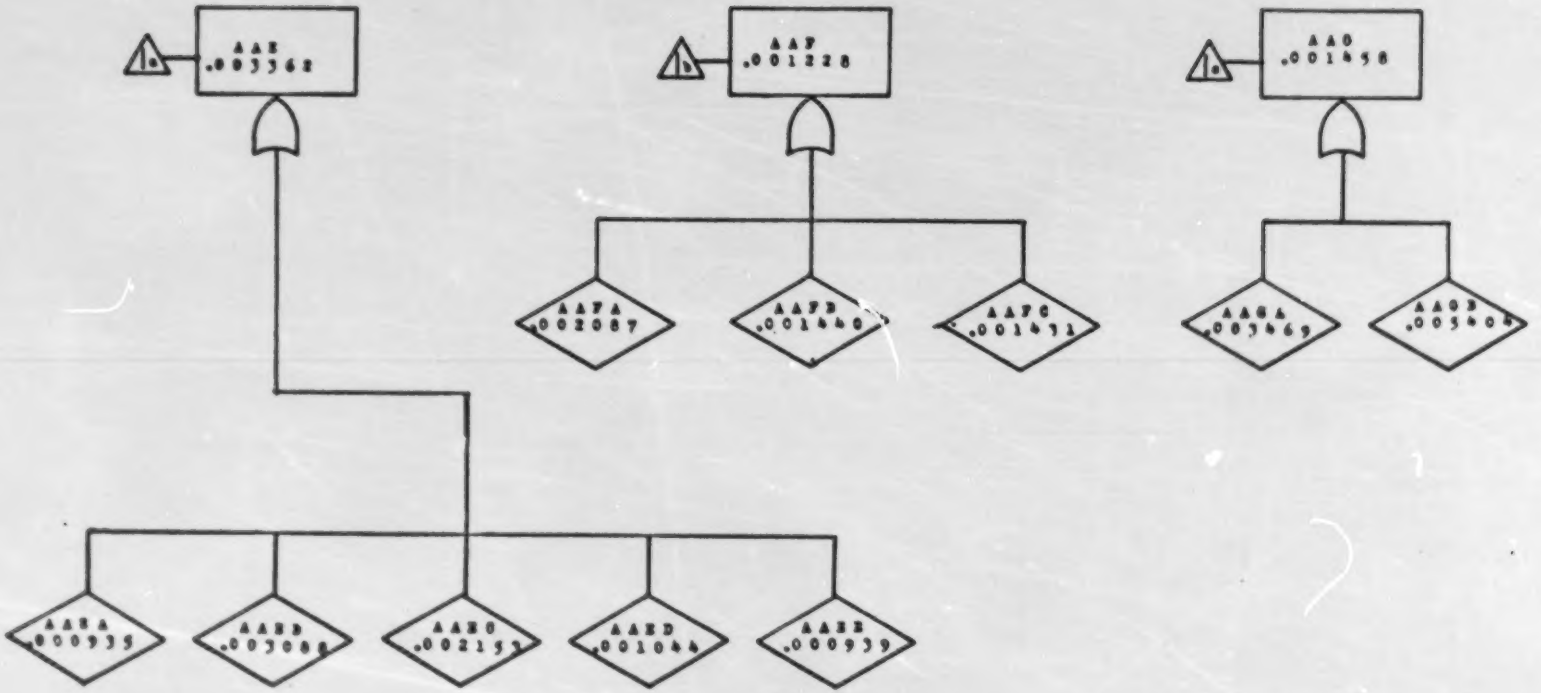
CE UTILIZATION is to structure and bring about the actual contact between learners and learning resources.

CF DISTRIBUTION is to acquire, organize, store, maintain, and distribute learning resources for use by and with learners.

APPENDIX H

FAULT TREE SCHEMATIC OF UNDESIRED EVENTS FOR BRANCH A
USE OF EXISTING LEARNING RESOURCES

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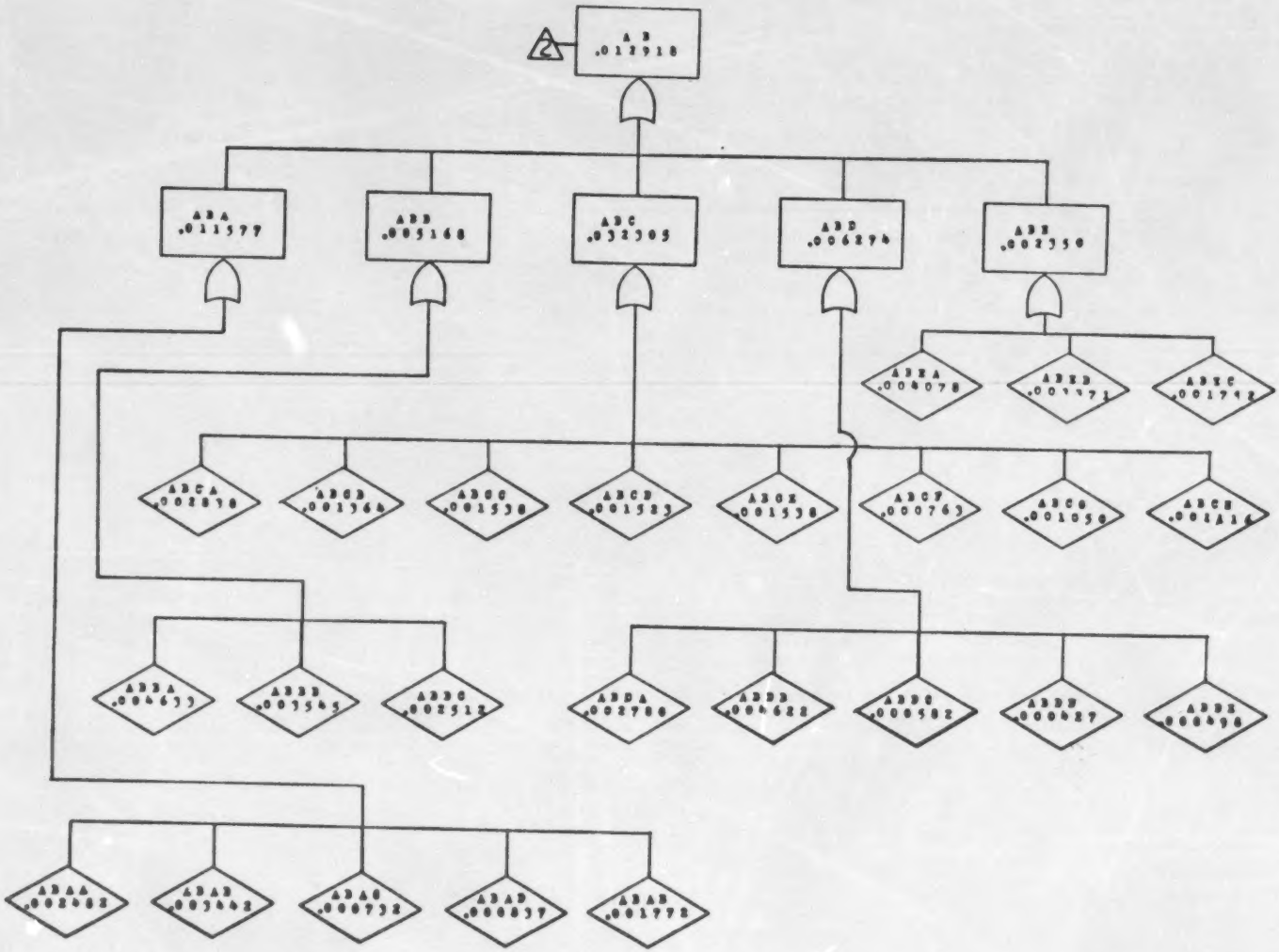
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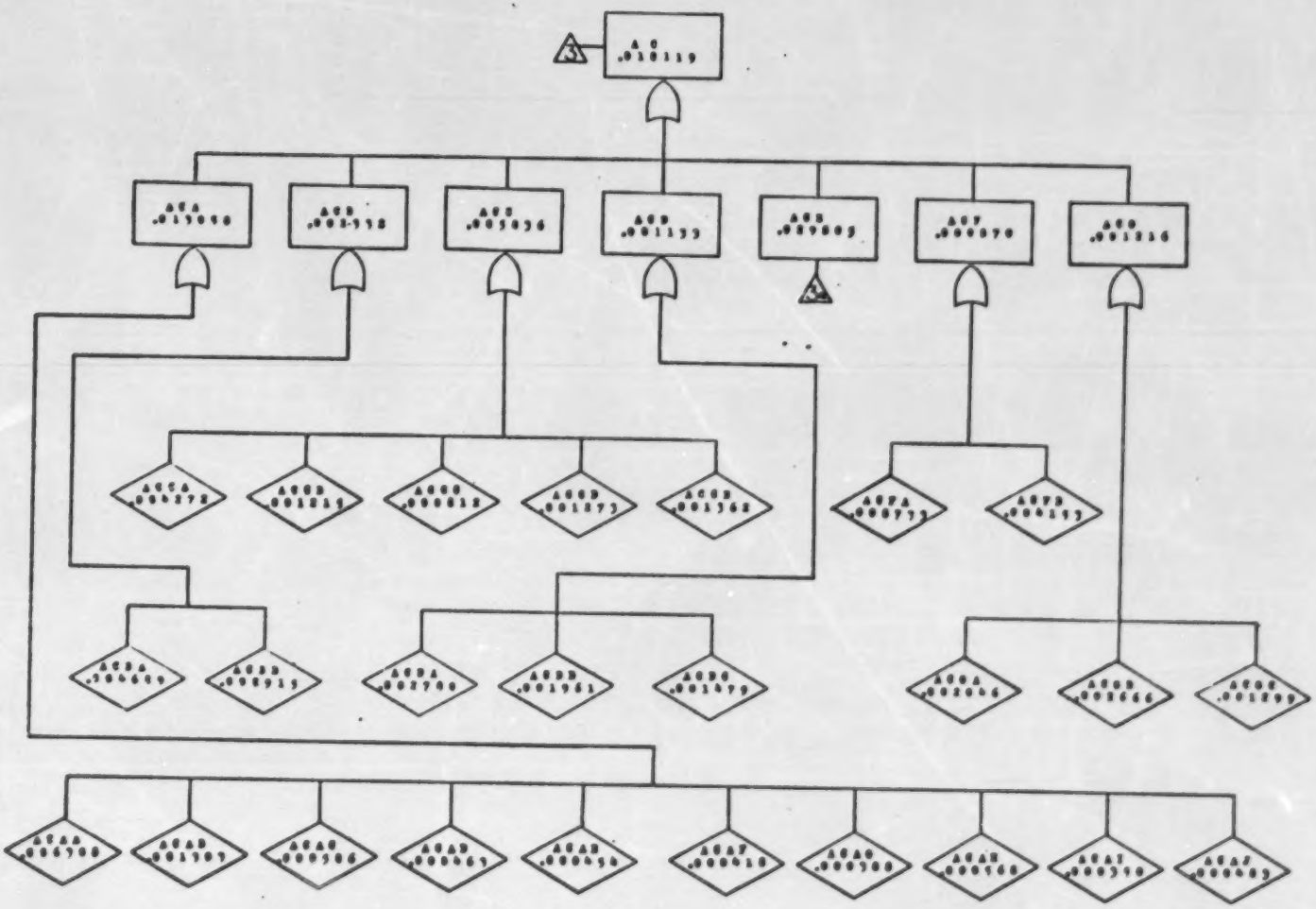

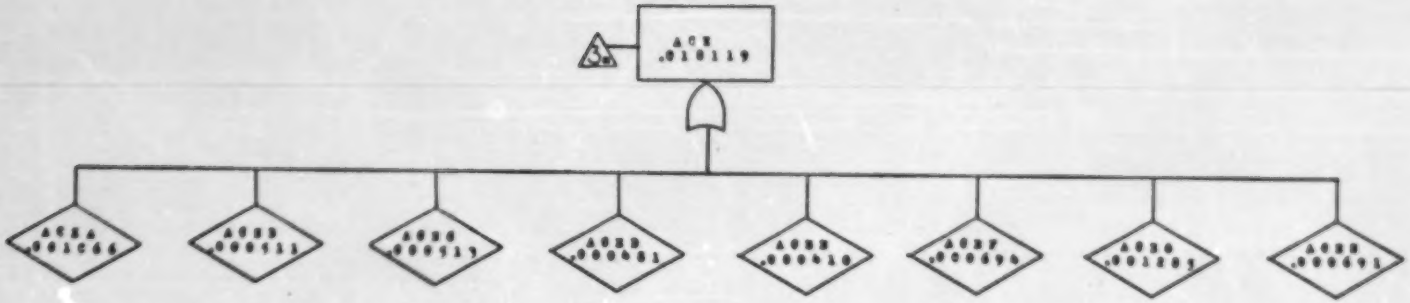

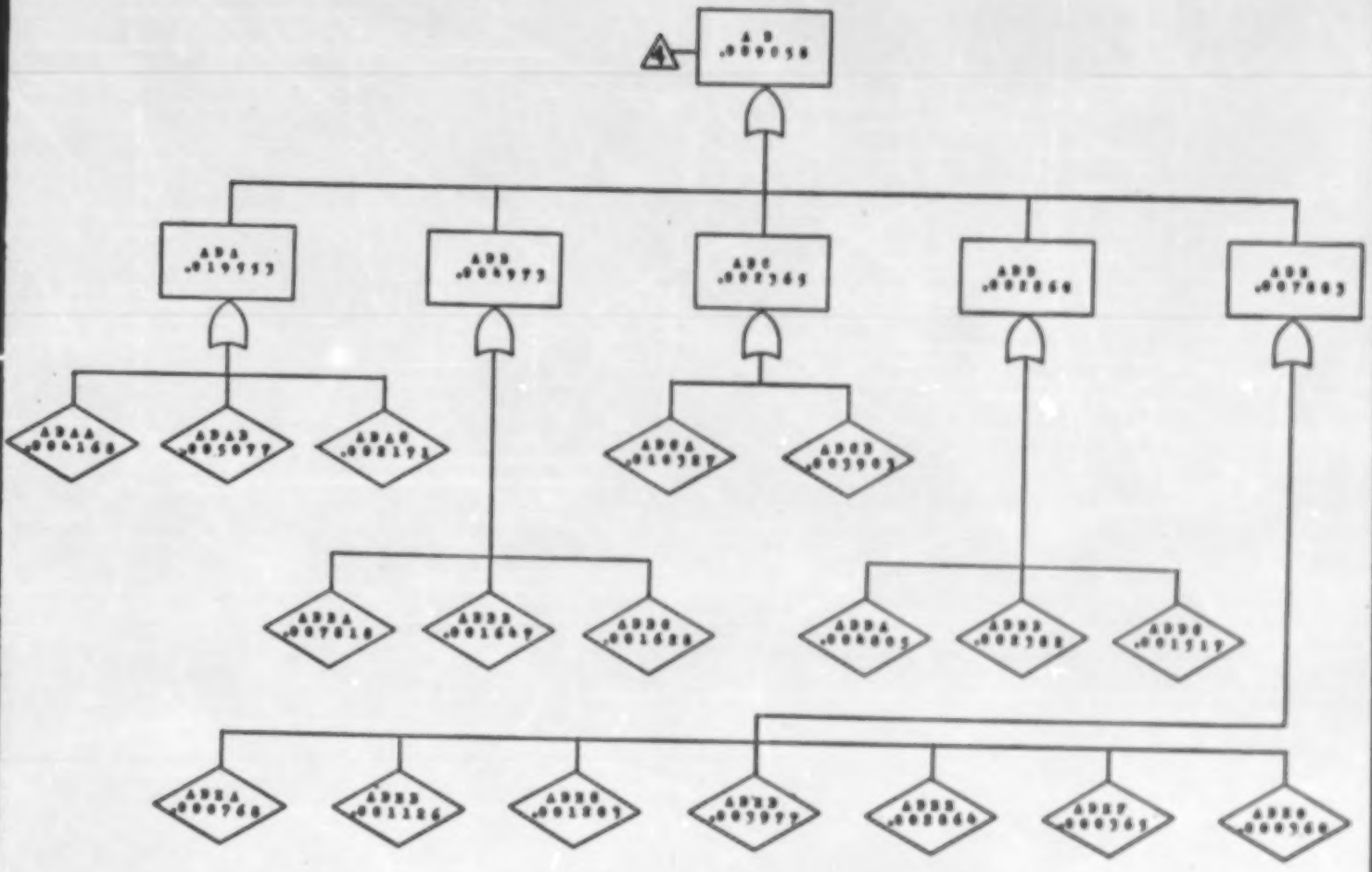

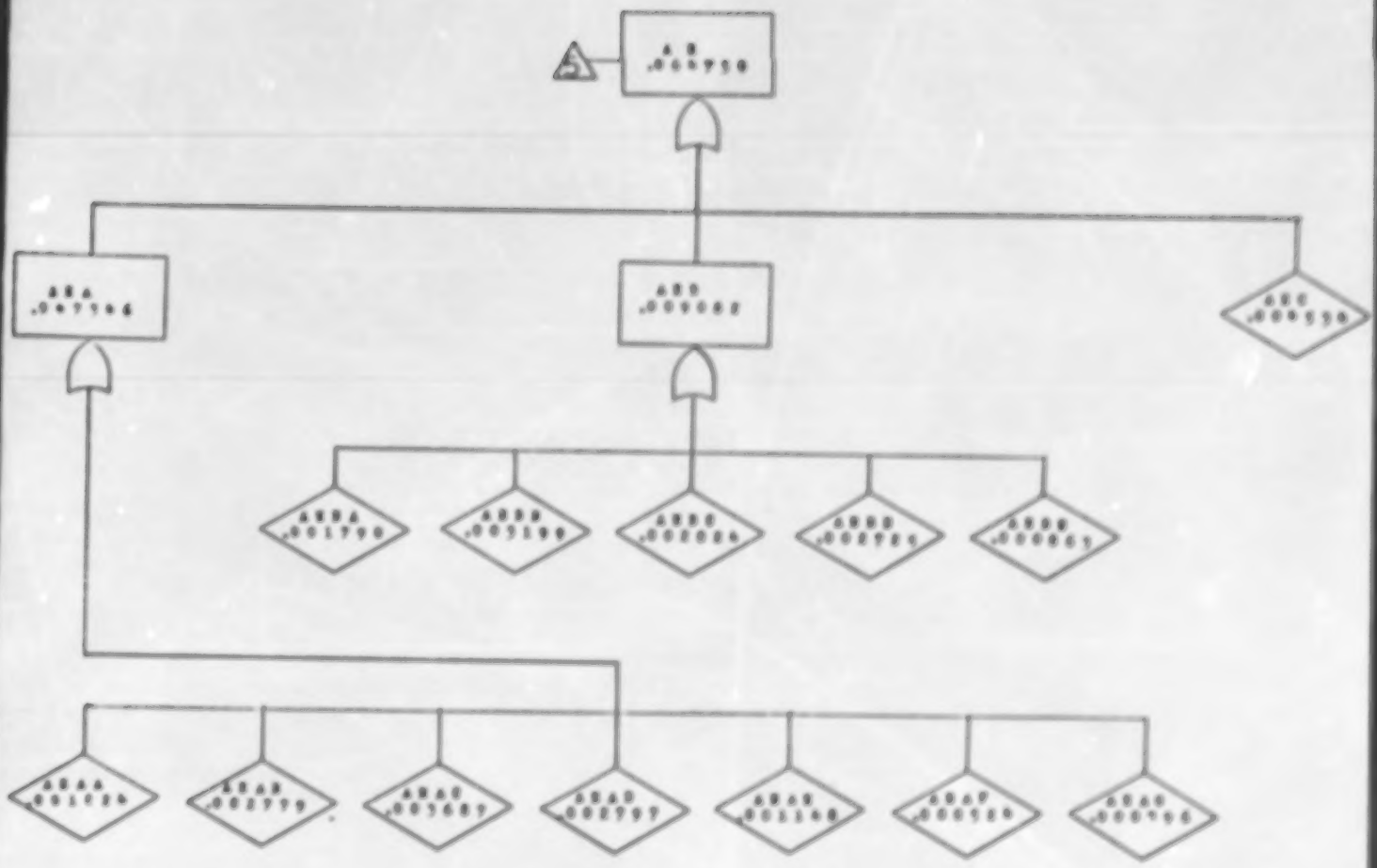

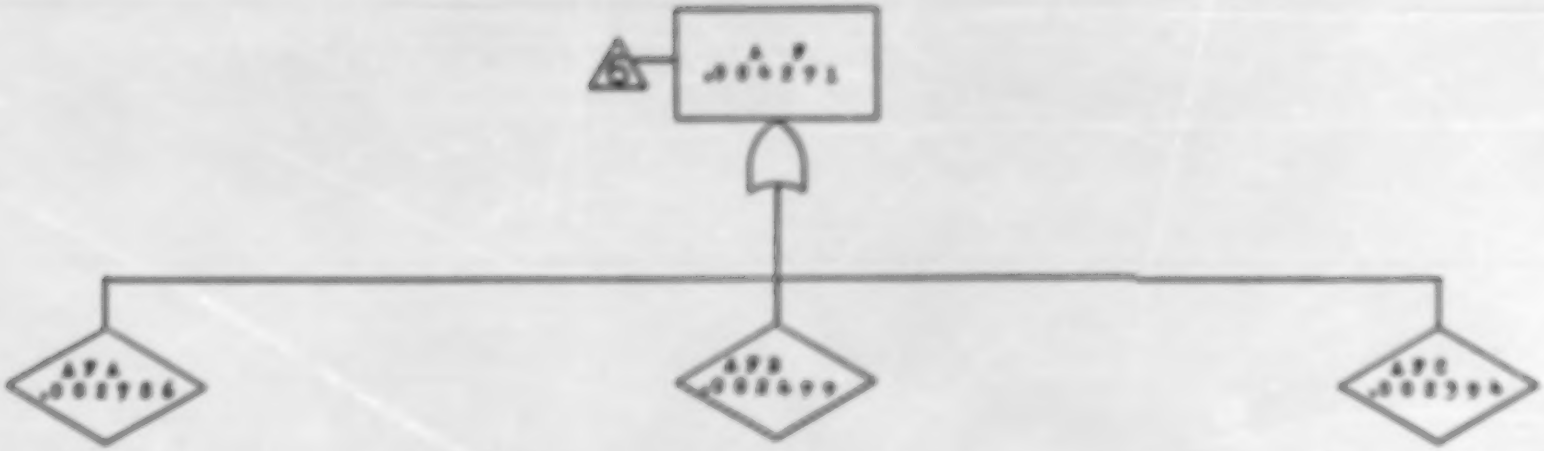

APPENDIX I

DRAWINGS & STATEMENTS

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AACE INEFFECTIVE USE OF PROJECTED/MAGNIFIED MATERIALS BECAUSE OF FAILURE TO EFFECTIVELY USE OVERHEAD TRANSPARENCIES.

AACF INEFFECTIVE USE OF PROJECTED/MAGNIFIED MATERIALS BECAUSE OF FAILURE TO EFFECTIVELY USE 16 MM FILMS.

AACG INEFFECTIVE USE OF PROJECTED/MAGNIFIED MATERIALS BECAUSE OF FAILURE TO EFFECTIVELY USE 8 MM FILMS.

AACH INEFFECTIVE USE OF PROJECTED/MAGNIFIED MATERIALS BECAUSE OF FAILURE TO EFFECTIVELY USE VIDEO DISCS/HOLOGRAPHS.

AAD INEFFECTIVE USE OF MATERIALS BECAUSE OF FAILURE TO EFFECTIVELY USE PRINTED/PICTORIAL MATERIALS.

AADA INEFFECTIVE USE OF PRINTED/PICTORIAL MATERIALS BECAUSE OF FAILURE TO EFFECTIVELY USE REFERENCE BOOKS (INDEXES, ABSTRACTS) ETC.

AADB INEFFECTIVE USE OF PRINTED PICTORIAL MATERIALS BECAUSE OF FAILURE TO EFFECTIVELY USE READING BOOKS (NOVELS, HISTORY) ETC.

AADC INEFFECTIVE USE OF PRINTED/PICTORIAL MATERIALS BECAUSE OF FAILURE TO EFFECTIVELY USE PERIODICALS.

AADD INEFFECTIVE USE OF PRINTED/PICTORIAL MATERIALS BECAUSE OF FAILURE TO USE NEWSPAPERS.

AADE INEFFECTIVE USE OF PRINTED/PICTORIAL MATERIALS BECAUSE OF FAILURE TO EFFECTIVELY USE MAPS.

AADF INEFFECTIVE USE OF PRINTED/PICTORIAL MATERIALS BECAUSE OF FAILURE TO EFFECTIVELY USE STUDY PRINTS.

AADG INEFFECTIVE USE OF PRINTED/PICTORIAL MATERIALS BECAUSE OF FAILURE TO USE EFFECTIVELY PHOTOGRAPHS.

AADH INEFFECTIVE USE OF PRINTED/PICTORIAL MATERIALS BECAUSE OF FAILURE TO EFFECTIVELY USE ART PRINTS.

AAE INEFFECTIVE USE OF MATERIALS BECAUSE OF FAILURE TO EFFECTIVELY USE THREE DIMENSIONAL MATERIALS.

AAEA INEFFECTIVE USE OF THREE DIMENSIONAL MATERIALS BECAUSE OF FAILURE TO EFFECTIVELY USE EXHIBITS.

AAEB INEFFECTIVE USE OF THREE DIMENSIONAL MATERIALS BECAUSE OF FAILURE TO EFFECTIVELY USE MODELS/MOCK-UPS.

AAEC INEFFECTIVE USE OF THREE DIMENSIONAL MATERIALS BECAUSE OF FAILURE TO EFFECTIVELY USE REALIA.

AAED INEFFECTIVE USE OF THREE DIMENSIONAL MATERIALS BECAUSE OF FAILURE TO EFFECTIVELY USE GLOBES/SIMULATIONS.

AAF INEFFECTIVE USE OF MATERIALS BECAUSE OF FAILURE TO EFFECTIVELY USE COMPUTER MATERIALS.

AAFA INEFFECTIVE USE OF COMPUTER MATERIALS BECAUSE OF FAILURE TO EFFECTIVELY USE COMPUTER READABLE MATERIALS (CARDS, TAPES, ETC.)

EVENTS	STATEMENTS
AAFB	INEFFECTIVE USE OF COMPUTER MATERIALS BECAUSE OF FAILURE TO EFFECTIVELY USE COMPUTER PRINTOUTS.
AAFC	INEFFECTIVE USE OF COMPUTER MATERIALS BECAUSE OF FAILURE TO EFFECTIVELY USE COMPUTER PROGRAMS.
AAG	INEFFECTIVE USE OF MATERIALS BECAUSE OF FAILURE TO EFFECTIVELY USE KITS.
AAGA	INEFFECTIVE USE OF KITS BECAUSE OF FAILURE TO EFFECTIVELY USE MULTI-MEDIA KITS.
AAGB	INEFFECTIVE USE OF KITS BECAUSE OF FAILURE TO EFFECTIVELY USE LEARNING PACKAGES.
ABA	INEFFECTIVE USE OF DEVICES BECAUSE OF FAILURE TO EFFECTIVELY USE AUDIO DEVICES.
ABAA	INEFFECTIVE USE OF AUDIO DEVICES BECAUSE OF FAILURE TO EFFECTIVELY USE AUDIOTAPE RECORDER.
ABAB	INEFFECTIVE USE OF AUDIO DEVICES BECAUSE OF FAILURE TO EFFECTIVELY USE AUDIOTAPE PLAYER.
ABAC	INEFFECTIVE USE OF AUDIO DEVICES BECAUSE OF FAILURE TO EFFECTIVELY USE AUDIOTAPE DUPLICATOR.
ABAD	INEFFECTIVE USE OF AUDIO DEVICES BECAUSE OF FAILURE TO EFFECTIVELY USE AUDIO MIXER.
ABAE	INEFFECTIVE USE OF AUDIO DEVICES BECAUSE OF FAILURE TO EFFECTIVELY USE LISTENING CENTERS.
AB	INADEQUATE USE OF EXISTING LEARNING RESOURCES BECAUSE OF FAILURE TO EFFECTIVELY USE DEVICES.
ABB	INEFFECTIVE USE OF DEVICES BECAUSE OF FAILURE TO EFFECTIVELY USE ELECTRONIC DISPLAY DEVICES.
ABBA	INEFFECTIVE USE OF ELECTRONIC DISPLAY DEVICES BECAUSE OF FAILURE TO EFFECTIVELY USE VIDEO RECORDERS.
ABBB	INEFFECTIVE USE OF ELECTRONIC DISPLAY DEVICES BECAUSE OF FAILURE TO EFFECTIVELY USE VIDEO PLAYER.
ABBC	INEFFECTIVE USE OF ELECTRONIC DISPLAY DEVICES BECAUSE OF FAILURE TO EFFECTIVELY USE VIDEO CAMERA.
ABC	INEFFECTIVE USE OF DEVICES BECAUSE OF FAILURE TO EFFECTIVELY USE OF PROJECTED/MAGNIFIED DISPLAY DEVICES.
ABCA	INEFFECTIVE USE OF PROJECTED/MAGNIFIED DISPLAY DEVICES BECAUSE OF FAILURE TO EFFECTIVELY USE 16 MM FILM PROJECTORS.
ABCB	INEFFECTIVE USE OF PROJECTED/MAGNIFIED DISPLAY DEVICES BECAUSE OF FAILURE TO EFFECTIVELY USE 8 MM FILM PROJECTORS.

EVENTS	STATEMENTS
ABCC	INEFFECTIVE USE OF PROJECTED/MAGNIFIED DISPLAY DEVICES BECAUSE OF FAILURE TO EFFECTIVELY USE FILMSTRIP PROJECTORS
ABCD	INEFFECTIVE USE OF PROJECTED/MAGNIFIED DISPLAY DEVICES BECAUSE OF FAILURE TO EFFECTIVELY USE SLIDE PROJECTORS
ABCE	INEFFECTIVE USE OF PROJECTED/MAGNIFIED DISPLAY DEVICES BECAUSE OF FAILURE TO EFFECTIVELY USE OVERHEAD PROJECTORS
ABCF	INEFFECTIVE USE OF PROJECTED/MAGNIFIED DISPLAY DEVICES BECAUSE OF FAILURE TO EFECTIVELY USE OPAQUE PROJECTORS
ABCG	INEFFECTIVE USE OF PROJECTED/MAGNIFIED DISPLAY DEVICES BECAUSE OF FAILURE TO EFFECTIVE USE PROJECTION/SOUND PROGRAMMERS
ABCH	INEFFECTIVE USE OF PROJECTED/MAGNIFIED DISPLAY DEVICES BECAUSE OF FAILURE TO EFFECTIVELY USE DISSOLVE UNITS
ABD	INEFFECTIVE USE OF DEVICES BECAUSE OF FAILURE TO EFFECTIVELY USE PHYSICAL DISPLAY DEVICES
ABDA	INEFFECTIVE USE OF PHYSICAL DISPLAY DEVICES BECAUSE OF FAILURE TO EFFECTIVELY USE BULLETING BOARDS
ABDB	INEFFECTIVE USE OF PHYSICAL DISPLAY DEVICES BECAUSE OF FAILURE TO EFFECTIVELY USE CHALK BOARDS
ABDC	INEFFECTIVE USE OF PHYSICAL DISPLAY DEVICES BECAUSE OF FAILURE TO EFFECTIVELY USE FELT BOARDS
ABDD	INEFFECTIVE USE OF PHYSICAL DISPLAY DEVICES BECAUSE OF FAILURE TO EFFECTIVELY USE HOOK AND LOOP BOARDS
ABDE	INEFFECTIVE USE OF PHYSICAL DISPLAY DEVICES BECAUSE OF FAILURE TO EFFECTIVELY USE MAGNETIC BOARDS
ABE	INEFFECTIVE USE OF DEVICES BECAUSE OF FAILURE TO EFFECTIVELY USE COMPUTER DEVICES
ABEA	INEFFECTIVE USE OF COMPUTER DEVICES BECAUSE OF FAILURE TO EFFECTIVELY USE COMPUTER TERMINALS
ABEB	INEFFECTIVE USE OF COMPUTER DEVICES BECAUSE OF FAILURE TO EFFECTIVELY USE COMPUTER INPUT DEVICES
ABEC	INEFFECTIVE USE OF COMPUTER DEVICES BECAUSE OF FAILURE TO EFFECTIVELY USE COMPUTER OUTPUT DEVICES

EVENTS	STATEMENTS
AC	INADEQUATE USE OF EXISTING LEARNING RESOURCES BECAUSE OF FAILURE TO EFFECTIVELY USE TECHNIQUES
ACA	INEFFECTIVE USE OF TECHNIQUES BECAUSE OF FAILURE TO EFFECTIVELY USE MEDIA WITH GENERAL TECHNIQUES
ACAA	INEFFECTIVE USE OF MEDIA WITH GENERAL TECHNIQUES BECAUSE OF FAILURE TO EFFECTIVELY USE MEDIA WITH LECTURES
ACAB	INEFFECTIVE USE OF MEDIA WITH GENERAL TECHNIQUES BECAUSE OF FAILURE TO EFFECTIVELY USE MEDIA WITH DISCUSSIONS
ACAC	INEFFECTIVE USE OF MEDIA WITH GENERAL TECHNIQUES BECAUSE OF FAILURE TO EFFECTIVELY USE MEDIA WITH DIRECTED OBSERVATIONS/TACTILE AND MANIPULATIVE ACTIVITIES
ACAD	INEFFECTIVE USE OF MEDIA WITH GENERAL TECHNIQUES BECAUSE OF FAILURE TO EFFECTIVELY USE MEDIA WITH MODELING AND IMITATION ACTIVITIES
ACAE	INEFFECTIVE USE OF MEDIA WITH GENERAL TECHNIQUES BECAUSE OF FAILURE TO EFFECTIVELY USE MEDIA WITH PRACTICE AND DRILL ACTIVITIES
ACAF	INEFFECTIVE USE OF MEDIA WITH GENERAL TECHNIQUES BECAUSE OF FAILURE TO EFFECTIVELY USE MEDIA WITH DEMONSTRATIONS AND DRAMATIZATIONS
ACAG	INEFFECTIVE USE OF MEDIA WITH GENERAL TECHNIQUES BECAUSE OF FAILURE TO EFFECTIVELY USE MEDIA WITH PROBLEM SOLVING AND PROJECTS
ACAH	INEFFECTIVE USE OF MEDIA WITH GENERAL TECHNIQUES BECAUSE OF FAILURE TO EFFECTIVELY USE MEDIA WITH LISTENING AND RECITATION
ACAI	INEFFECTIVE USE OF MEDIA WITH GENERAL TECHNIQUES BECAUSE OF FAILURE TO EFFECTIVELY USE MEDIA WITH GAMING AND SIMULATIONS
ACAJ	INEFFECTIVE USE OF MEDIA WITH GENERAL TECHNIQUES BECAUSE OF FAILURE TO EFFECTIVELY USE MEDIA WITH EXPERIMENTATION
ACB	INEFFECTIVE USE OF TECHNIQUES BECAUSE OF FAILURE TO USE MEDIA-BASED SELF-INSTRUCTIONAL TECHNIQUES
ACBA	INEFFECTIVE USE OF MEDIA-BASED SELF-INSTRUCTIONAL TECHNIQUES BECAUSE OF FAILURE TO EFFECTIVELY USE AUTO-TUTORIAL TECHNIQUES OF INSTRUCTION

EVENTS	STATEMENTS
ACBB	INEFFECTIVE USE OF MEDIA-BASED SELF-INSTRUCTIONAL TECHNIQUES BECAUSE OF FAILURE TO EFFECTIVELY USE PROGRAMMED INSTRUCTION
ACC	INEFFECTIVE USE OF TECHNIQUES BECAUSE OF FAILURE TO EFFECTIVELY USE SETTINGS
ACCA	INEFFECTIVE USE OF SETTINGS BECAUSE OF FAILURE TO EFFECTIVELY USE OPEN CLASSROOM TECHNIQUES
ACCB	INEFFECTIVE USE OF SETTINGS BECAUSE OF FAILURE TO EFFECTIVELY USE LABORATORY TECHNIQUES
ACCC	INEFFECTIVE USE OF SETTINGS BECAUSE OF FAILURE TO EFFECTIVELY USE HOME INSTRUCTION TECHNIQUES
ACCD	INEFFECTIVE USE OF SETTINGS BECAUSE OF FAILURE TO EFFECTIVELY USE FIELD TRIP TECHNIQUES
ACCE	INEFFECTIVE USE OF SETTINGS BECAUSE OF FAILURE TO EFFECTIVELY USE FIELD EXPERIENCE TECHNIQUES
ACD	INEFFECTIVE USE OF TECHNIQUES BECAUSE OF FAILURE TO EFFECTIVELY USE COMPUTER BASED TECHNIQUES
ACDA	INEFFECTIVE USE OF COMPUTER BASED TECHNIQUES BECAUSE OF FAILURE TO EFFECITVELY USE COMPUTER ASSISTED INSTRUCTION
ACDB	INEFFECTIVE USE OF COMPUTER BASED TECHNIQUES BECAUSE OF FAILURE TO EFFECTIVELY USE COMPUTER MANAGED INSTRUCTION
ACDC	INEFFECTIVE USE OF COMPUTER BASED TECHNIQUES BECAUSE OF FAILURE TO EFFECTIVELY USE COMPUTER SIMULATED INSTRUCTION
ACE	INEFFECTIVE USE OF TECHNIQUES BECAUSE OF FAILURE TO EFFECTIVELY USE PEOPLE BASED INSTRUCTION
ACEA	INEFFECTIVE USE OF PEOPLE BASED INSTRUCTION BECAUSE OF FAILURE TO EFFECTIVELY USE PEER-TEACHING
ACEB	INEFFECTIVE USE OF PEOPLE BASED INSTRUCTION BECAUSE OF FAILURE TO EFFECTIVELY USE CROSS-AGE TEACHING
ACEC	INEFFECTIVE USE OF PEOPLE BASED INSTRUCTION BECAUSE OF FAILURE TO EFFECTIVELY USE TEAM TEACHING
ACED	INEFFECTIVE USE OF PEOPLE BASED INSTRUCTION BECAUSE OF FAILURE TO EFFECTIVELY USE SEMINAR TEACHING
ACEE	INEFFECTIVE USE OF PEOPLE BASED INSTRUCTION BECAUSE OF FAILURE TO EFFECTIVELY USE PEER TUTORING

EVENTS	STATEMENTS
ACEF	INEFFECTIVE USE OF PEOPLE BASED INSTRUCTION BECAUSE OF FAILURE TO EFFECTIVELY USE CROSS-AGE TUTORING
ACEG	INEFFECTIVE USE OF PEOPLE BASED INSTRUCTION BECAUSE OF FAILURE TO EFFECTIVELY USE LARGE-SMALL GROUP INSTRUCTION
ACEH	INEFFECTIVE USE OF PEOPLE BASED INSTRUCTION BECAUSE OF FAILURE TO EFFECTIVELY USE INDEPENDENT STUDY TECHNIQUES
ACF	INEFFECTIVE USE OF TECHNIQUES BECAUSE OF FAILURE TO EFFECTIVELY USE TELEVISION BASED INSTRUCTION
ACFA	INEFFECTIVE USE OF TELEVISION BASED INSTRUCTION BECAUSE OF FAILURE TO EFFECTIVELY USE EDUCATIONAL/INSTRUCTIONAL TELEVISION
ACFB	INEFFECTIVE USE OF TELEVISION BASED INSTRUCTION BECAUSE OF FAILURE TO EFFECTIVELY USE COMMERCIAL TELEVISION FOR INSTRUCTION
ACG	INEFFECTIVE USE OF TECHNIQUES BECAUSE OF FAILURE TO EFFECTIVELY USE REMOTE ACCESS INSTRUCTIONAL TECHNIQUES
ACGA	INEFFECTIVE USE OF REMOTE ACCESS INSTRUCTIONAL TECHNIQUES BECAUSE OF FAILURE TO EFFECTIVELY USE TELEPHONE BASED INSTRUCTION
ACGB	INEFFECTIVE USE OF REMOTE ACCESS INSTRUCTIONAL TECHNIQUES BECAUSE OF FAILURE TO EFFECTIVELY USE DIAL ACCESS INSTRUCTION
ACGC	INEFFECTIVE USE OF REMOTE ACCESS INSTRUCTIONAL TECHNIQUES BECAUSE OF FAILURE TO EFFECTIVELY USE RADIO/TELEVISION BASED REMOTE ACCESS TECHNIQUES
AD	INADEQUATE USE OF EXISTING LEARNING RESOURCES BECAUSE OF FAILURE TO EFFECTIVELY USE SETTINGS
ADA	INEFFECTIVE USE OF SETTINGS BECAUSE OF FAILURE TO EFFECTIVELY USE LIBRARY MEDIA CENTER SPACE
ADAA	INEFFECTIVE USE OF LIBRARY MEDIA CENTER SPACE BECAUSE OF FAILURE TO EFFECTIVELY USE READING AREAS
ADAB	INEFFECTIVE USE OF LIBRARY MEDIA CENTER SPACE BECAUSE OF FAILURE TO EFFECTIVELY USE LISTENING/VIEWING AREAS
ADAC	INEFFECTIVE USE OF LIBRARY MEDIA CENTER SPACE BECAUSE OF FAILURE TO EFFECTIVELY USE SATELLITE CENTERS

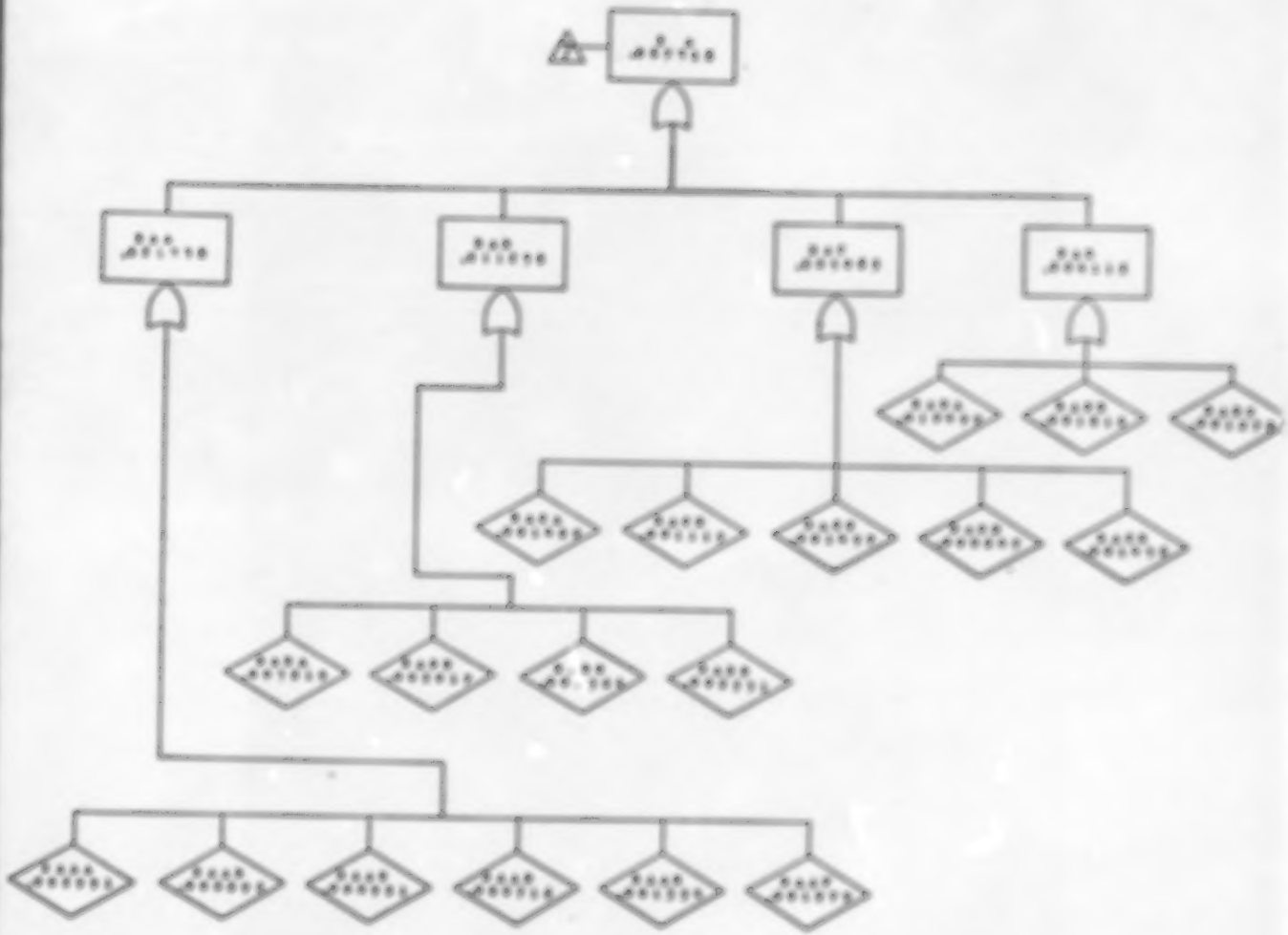
EVENTS	STATEMENTS
ADB	INEFFECTIVE USE OF SETTINGS BECAUSE OF FAILURE TO EFFECTIVELY USE SPECIAL INSTRUCTIONAL SPACE
ADBA	INEFFECTIVE USE OF SPECIAL INSTRUCTIONAL SPACE BECAUSE OF FAILURE TO EFFECTIVELY USE MEDIA BASED LABORATORIES
ADBB	INEFFECTIVE USE OF SPECIAL INSTRUCTIONAL SPACE BECAUSE OF FAILURE TO EFFECTIVELY USE COMPUTER BASED LABORATORIES
ADBC	INEFFECTIVE USE OF SPECIAL INSTRUCTIONAL SPACE BECAUSE OF FAILURE TO EFFECTIVELY USE SHOP/MUSIC/SCIENCE LABORATORIES, ETC.
ADC	INEFFECTIVE USE OF SETTINGS BECAUSE OF FAILURE TO EFFECTIVELY USE GENERAL USE SPACE
ADDA	INEFFECTIVE USE OF GENERAL USE SPACE BECAUSE OF FAILURE TO EFFECTIVELY USE MULTIPLE-PURPOSE AREAS
ADCB	INEFFECTIVE USE OF GENERAL USE SPACE BECAUSE OF FAILURE TO EFFECTIVELY USE LARGE GROUP/AUDITORIUM SPACES
ADD	INEFFECTIVE USE OF SETTINGS BECAUSE OF FAILURE TO EFFECTIVELY USE SPECIAL USE SPACE
ADDA	INEFFECTIVE USE OF SPECIAL USE SPACE BECAUSE OF FAILURE TO EFFECTIVELY USE DEMONSTRATION AREAS
ADDB	INEFFECTIVE USE OF SPECIAL USE SPACE BECAUSE OF FAILURE TO EFFECTIVELY USE GALLERY AREAS
ADDC	INEFFECTIVE USE OF SPECIAL USE SPACE BECAUSE OF FAILURE TO EFFECTIVELY USE MUSEUM AREAS
ADE	INEFFECTIVE USE OF SETTINGS BECAUSE OF FAILURE TO EFFECTIVELY USE INSTRUCTIONAL SUPPORT SPACE
ADEA	INEFFECTIVE USE OF INSTRUCTIONAL SUPPORT SPACE BECAUSE OF FAILURE TO EFFECTIVELY USE SOUND STUDIOS
ADEB	INEFFECTIVE USE OF INSTRUCTIONAL SUPPORT SPACE BECAUSE OF FAILURE TO EFFECTIVELY USE PHOTO STUDIOS
ADEC	INEFFECTIVE USE OF INSTRUCTIONAL SUPPORT SPACE BECAUSE OF FAILURE TO EFFECTIVELY USE TELEVISION STUDIOS
ADED	INEFFECTIVE USE OF INSTRUCTIONAL SUPPORT SPACE BECAUSE OF FAILURE TO EFFECTIVELY USE GRAPHIC REPRODUCTION AREAS

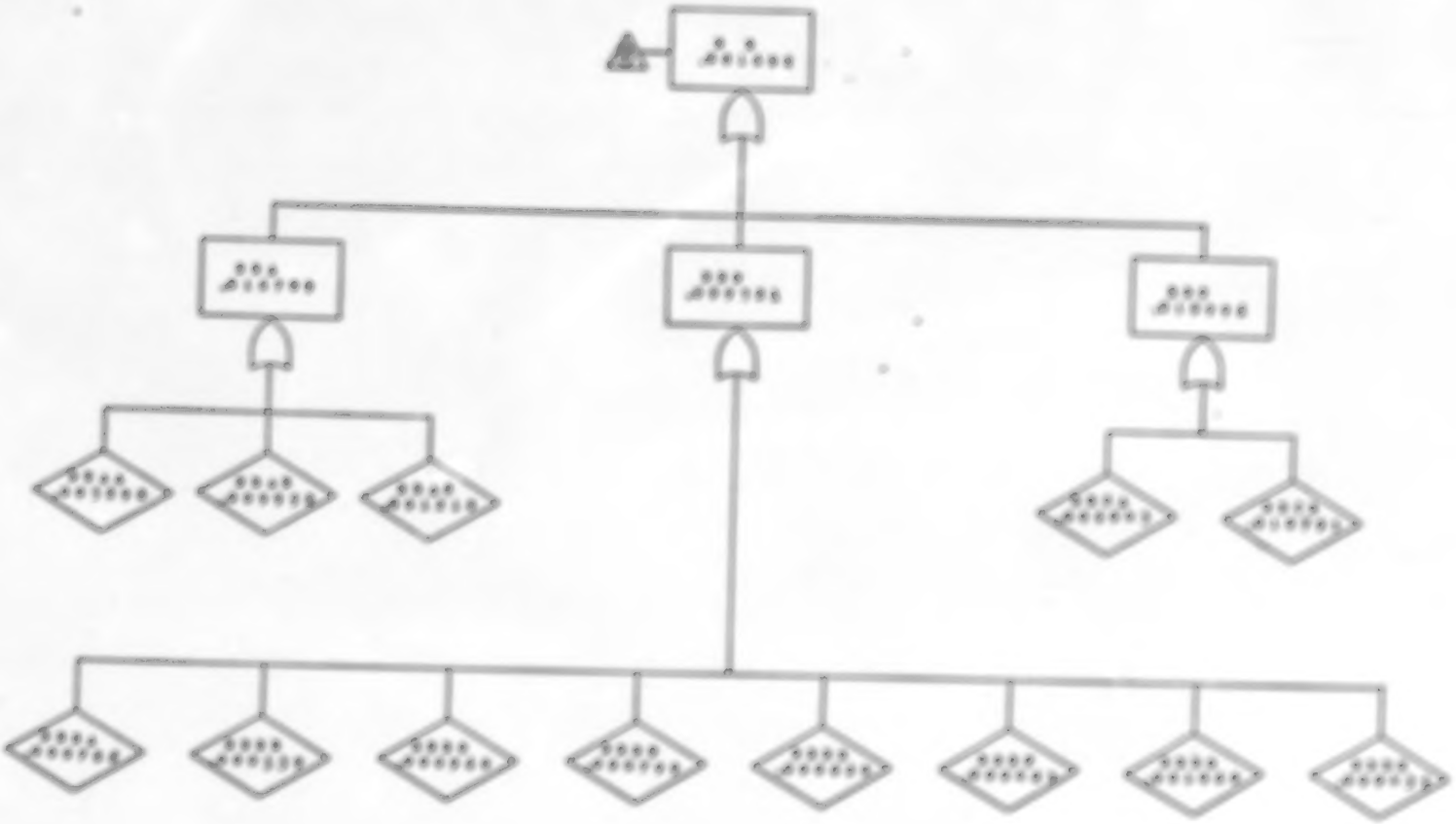
EVENTS	STATEMENTS
ADEE	INEFFECTIVE USE OF INSTRUCTIONAL SUPPORT SPACE BECAUSE OF FAILURE TO EFFECTIVELY USE CURRICULUM LABORATORY/LIBRARY
ADEF	INEFFECTIVE USE OF INSTRUCTIONAL SUPPORT SPACE BECAUSE OF FAILURE TO EFFECTIVE USE MAINTENANCE/REPAIR SHOP
ADEG	INEFFECTIVE USE OF INSTRUCTIONAL SUPPORT SPACE BECAUSE OF FAILURE TO EFFECTIVELY USE COMPUTER CENTER
AE	INEFFECTIVE USE OF EXISTING LEARNING RESOURCES BECAUSE OF FAILURE TO EFFECTIVELY USE PEOPLE
AEA	INEFFECTIVE USE OF PEOPLE BECAUSE OF FAILURE TO EFFECTIVELY USE SPECIALISTS
AEAA	INEFFECTIVE USE OF SPECIALISTS BECAUSE OF FAILURE TO EFFECTIVELY USE INFORMATION/REFERENCE SPECIALISTS
AEAB	INEFFECTIVE USE OF SPECIALISTS BECAUSE OF FAILURE TO EFFECTIVELY USE INSTRUCTIONAL DEVELOPMENT SPECIALISTS
AEAC	INEFFECTIVE USE OF SPECIALISTS BECAUSE OF FAILURE TO EFFECTIVELY USE MEDIA PRODUCTION SPECIALISTS
AEAD	INEFFECTIVE USE OF SPECIALISTS BECAUSE OF FAILURE TO EFFECTIVELY USE MEDIA MANAGEMENT SPECIALISTS
AEAE	INEFFECTIVE USE OF SPECIALISTS BECAUSE OF FAILURE TO EFFECTIVELY USE FACULTY DEVELOPMENT SPECIALISTS
AEAF	INEFFECTIVE USE OF SPECIALISTS BECAUSE OF FAILURE TO EFFECTIVELY USE RESEARCH SPECIALISTS
AEAG	INEFFECTIVE USE OF SPECIALISTS BECAUSE OF FAILURE TO EFFECTIVELY USE COMPUTER SPECIALISTS
AEB	INEFFECTIVE USE OF PEOPLE BECAUSE OF FAILURE TO EFFECTIVELY USE TECHNICIANS
AEBA	INEFFECTIVE USE OF TECHNICIANS BECAUSE OF FAILURE TO EFFECTIVELY USE MEDIA PRODUCTION TECHNICIANS
AEBB	INEFFECTIVE USE OF TECHNICIANS BECAUSE OF FAILURE TO EFFECTIVELY USE LIBRARY MEDIA CENTER TECHNICIANS
AEBC	INEFFECTIVE USE OF TECHNICIANS BECAUSE OF FAILURE TO EFFECTIVELY USE TECHNICAL SERVICES MEDIA TECHNICIANS
AEBD	INEFFECTIVE USE OF TECHNICIANS BECAUSE OF FAILURE TO EFFECTIVELY USE MEDIA MAINTENANCE TECHNICIANS

EVENTS	STATEMENTS
AEBE	INEFFECTIVE USE OF TECHNICIANS BECAUSE OF FAILURE TO EFFECTIVELY USE COMPUTER TECHNICIANS
AF	INADEQUATE USE OF EXISTING LEARNING RESOURCES BECAUSE OF FAILURE TO EFFECTIVELY USE CONTENT
AFA	INEFFECTIVE USE OF CONTENT BECAUSE OF FAILURE TO EFFECTIVELY USE SCIENCE CONTENT
AFB	INEFFECTIVE USE OF CONTENT BECAUSE OF FAILURE TO EFFECTIVELY USE SOCIAL SCIENCE CONTENT
AFC	INEFFECTIVE USE OF CONTENT BECAUSE OF FAILURE TO EFFECTIVELY USE ARTS AND HUMANITIES CONTENT

APPENDIX J

FAULT TREE SCHEMATIC OF UNDESIRED EVENTS FOR BRANCH B,
USE OF INSTRUCTIONAL MANAGEMENT





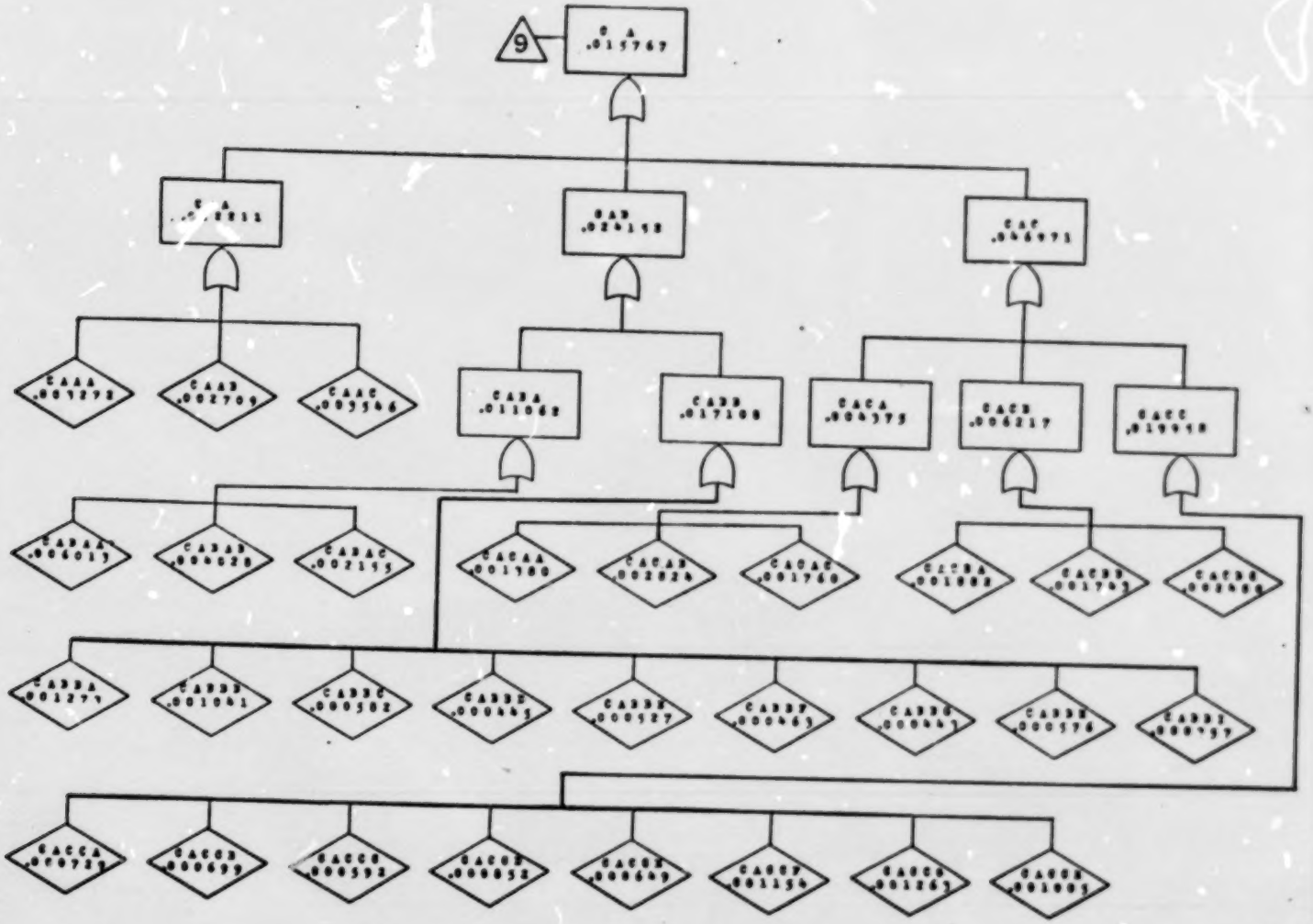
EVENTS	STATEMENTS
B	FAILURE OF THE MISSION BECAUSE OF INADEQUATE USE OF INSTRUCTIONAL MANAGEMENT
BA	INADEQUATE USE OF INSTRUCTIONAL MANAGEMENT BECAUSE OF FAILURE TO EFFECTIVELY USE ORGANIZATIONAL MANAGEMENT
BAA	INEFFECTIVE USE OF ORGANIZATIONAL MANAGEMENT BECAUSE OF FAILURE TO EFFECTIVELY USE GOALS AND POLICIES
BAAA	INEFFECTIVE USE OF GOALS AND POLICIES BECAUSE OF FAILURE TO EFFECTIVELY USE GOALS AND POLICIES ABOUT ROLES AND PURPOSES
BAAB	INEFFECTIVE USE OF GOALS AND POLICIES BECAUSE OF FAILURE TO EFFECTIVELY USE GOALS AND POLICIES ABOUT INSTRUCTIONAL PROGRAMS
BAAC	INEFFECTIVE USE OF GOALS AND POLICIES BECAUSE OF FAILURE TO EFFECTIVELY USE GOALS AND POLICIES ABOUT LEARNERS
BAAD	INEFFECTIVE USE OF GOALS AND POLICIES BECAUSE OF FAILURE TO EFFECTIVELY USE GOALS AND POLICIES ABOUT LEARNING RESOURCES
BAAE	INEFFECTIVE USE OF GOALS AND POLICIES BECAUSE OF FAILURE TO EFFECTIVELY USE GOALS AND POLICIES ABOUT LEARNING RESOURCES DEVELOPMENT
BAAF	INEFFECTIVE USE OF GOALS AND POLICIES BECAUSE OF FAILURE TO EFFECTIVELY USE GOALS AND POLICIES ABOUT INSTRUCTIONAL MANAGEMENT
BAB	INEFFECTIVE USE OF ORGANIZATIONAL MANAGEMENT BECAUSE OF FAILURE TO EFFECTIVELY IMPLEMENT GOALS AND POLICIES
BABA	INEFFECTIVE IMPLEMENTATION OF GOALS AND OBJECTIVES BECAUSE OF FAILURE TO PLAN FOR IMPLEMENTATION
BABB	INEFFECTIVE IMPLEMENTATION OF GOALS AND OBJECTIVES BECAUSE OF FAILURE TO ASSESS FOR IMPLEMENTATION
BABC	INEFFECTIVE IMPLEMENTATION OF GOALS AND OBJECTIVES BECAUSE OF FAILURE TO OBTAIN INFORMATION FOR IMPLEMENTATION
BABD	INEFFECTIVE IMPLEMENTATION OF GOALS AND OBJECTIVES BECAUSE OF FAILURE TO APPLY IMPLEMENTATION
BAC	INEFFECTIVE USE OF ORGANIZATIONAL MANAGEMENT BECAUSE OF FAILURE TO EFFECTIVELY USE MANAGEMENT SERVICES

EVENTS	STATEMENTS
BACA	INEFFECTIVE USE OF MANAGEMENT SERVICES BECAUSE OF FAILURE TO USE FISCAL SERVICES
BACB	INEFFECTIVE USE OF MANAGEMENT SERVICES BECAUSE OF FAILURE TO USE PROPERTY MANAGEMENT SERVICES
BACC	INEFFECTIVE USE OF MANAGEMENT SERVICES BECAUSE OF FAILURE TO USE LEGAL SERVICES
BACD	INEFFECTIVE USE OF MANAGEMENT SERVICES BECAUSE OF FAILURE TO USE RECORDS SERVICES
BAD	INEFFECTIVE USE OF ORGANIZATIONAL MANAGEMENT BECAUSE OF FAILURE TO USE COORDINATION OF PROGRAM ACTIVITIES
BADA	INEFFECTIVE COORDINATION OF PROGRAM ACTIVITIES BECAUSE OF FAILURE TO USE INTERNAL COORDINATION
BADB	INEFFECTIVE COORDINATION OF PROGRAM ACTIVITIES BECAUSE OF FAILURE TO USE INTERORGANIZATION/INTERINSTITUTIONAL COORDINATION
BADC	INEFFECTIVE COORDINATION OF PROGRAM ACTIVITIES BECAUSE OF FAILURE TO USE OTHER EXTERNAL COORDINATION
BB	INADEQUATE USE OF INSTRUCTIONAL MANAGEMENT BECAUSE OF FAILURE TO EFFECTIVELY USE PERSONNEL MANAGEMENT
BBA	INEFFECTIVE USE OF PERSONNEL MANAGEMENT BECAUSE OF FAILURE TO EFFECTIVELY USE PERSONNEL EMPLOYMENT
BBAA	INEFFECTIVE USE OF PERSONNEL EMPLOYMENT BECAUSE OF FAILURE TO USE PERSONNEL RECRUITMENT
BBAB	INEFFECTIVE USE OF PERSONNEL EMPLOYMENT BECAUSE OF FAILURE TO USE PERSONNEL SELECTION
BBAC	INEFFECTIVE USE OF PERSONNEL EMPLOYMENT BECAUSE OF FAILURE TO USE PERSONNEL SEPARATION
BBB	INEFFECTIVE USE OF PERSONNEL MANAGEMENT BECAUSE OF FAILURE TO EFFECTIVELY USE PERSONNEL ACCOUNTING
BBBA	INEFFECTIVE USE OF PERSONNEL ACCOUNTING BECAUSE OF FAILURE TO USE PERSONNEL EDUCATION AND EXPERIENCE ACCOUNTING
BBBB	INEFFECTIVE USE OF PERSONNEL ACCOUNTING BECAUSE OF FAILURE TO USE PERSONNEL HEALTH RECORDS

EVENTS	STATEMENTS
BBBC	INEFFECTIVE USE OF PERSONNEL ACCOUNTING BECAUSE OF FAILURE TO USE PERSONNEL JOB CLASSIFICATION, ACTIVITY AND ASSIGNMENT ACCOUNTING
BBBD	INEFFECTIVE USE OF PERSONNEL ACCOUNTING BECAUSE OF FAILURE TO USE FUNCTION AND PROGRAM ASSIGNMENT ACCOUNTING
BBBE	INEFFECTIVE USE OF PERSONNEL ACCOUNTING BECAUSE OF FAILURE TO USE PERSONNEL SUBJECT MATTER AREAS ACCOUNTING
BBBF	INEFFECTIVE USE OF PERSONNEL ACCOUNTING BECAUSE OF FAILURE TO USE PERSONNEL CURRENT ASSIGNMENT AND CONDITION ACCOUNTING
BBBG	INEFFECTIVE USE OF PERSONNEL ACCOUNTING BECAUSE OF FAILURE TO USE CURRENT EMPLOYMENT ACCOUNTING
BBBH	INEFFECTIVE USE OF PERSONNEL ACCOUNTING BECAUSE OF FAILURE TO USE PERSONNEL CAREER DEVELOPMENT ACCOUNTING
BBC	INEFFECTIVE USE OF PERSONNEL MANAGEMENT BECAUSE OF FAILURE TO EFFECTIVELY USE PERSONNEL DEVELOPMENT
BBCA	INEFFECTIVE USE OF PERSONNEL DEVELOPMENT BECAUSE OF FAILURE TO USE PRESERVICE TRAINING/ORIENTATION
BBCB	INEFFECTIVE USE OF PERSONNEL DEVELOPMENT BECAUSE OF FAILURE TO USE INSERVICE TRAINING

APPENDIX L

FAULT TREE SCHEMATIC OF UNDESIRED EVENTS FOR BRANCH C, USE OF LEARNING RESOURCES DEVELOPMENT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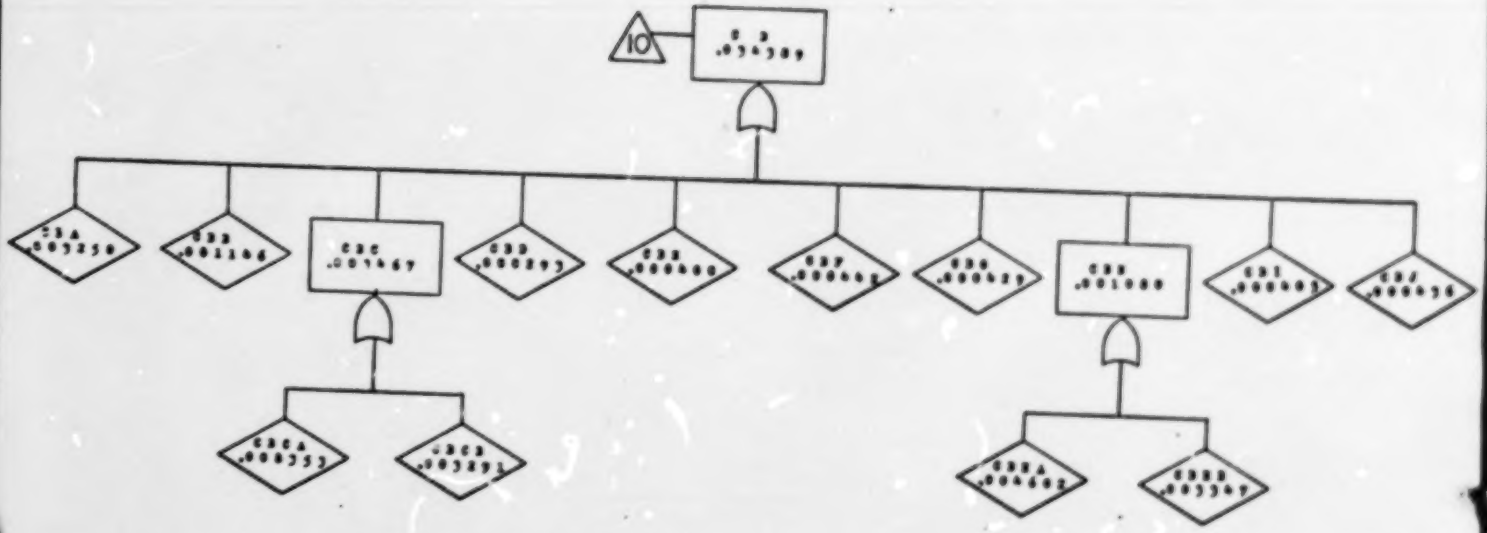
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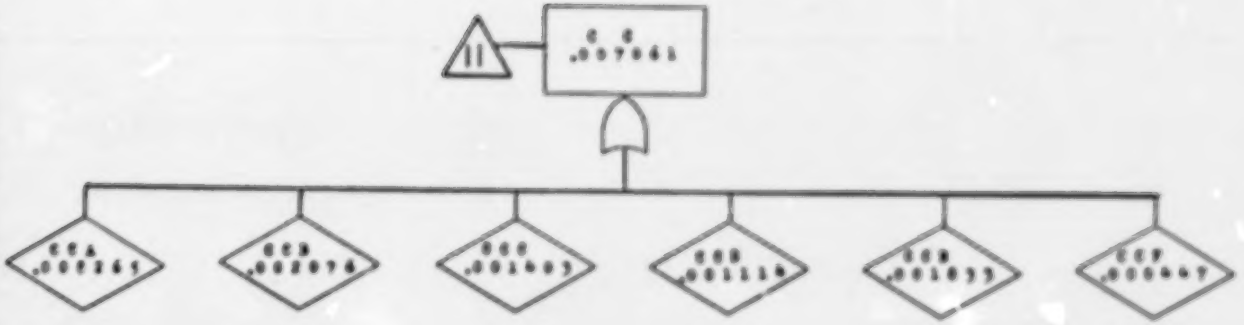

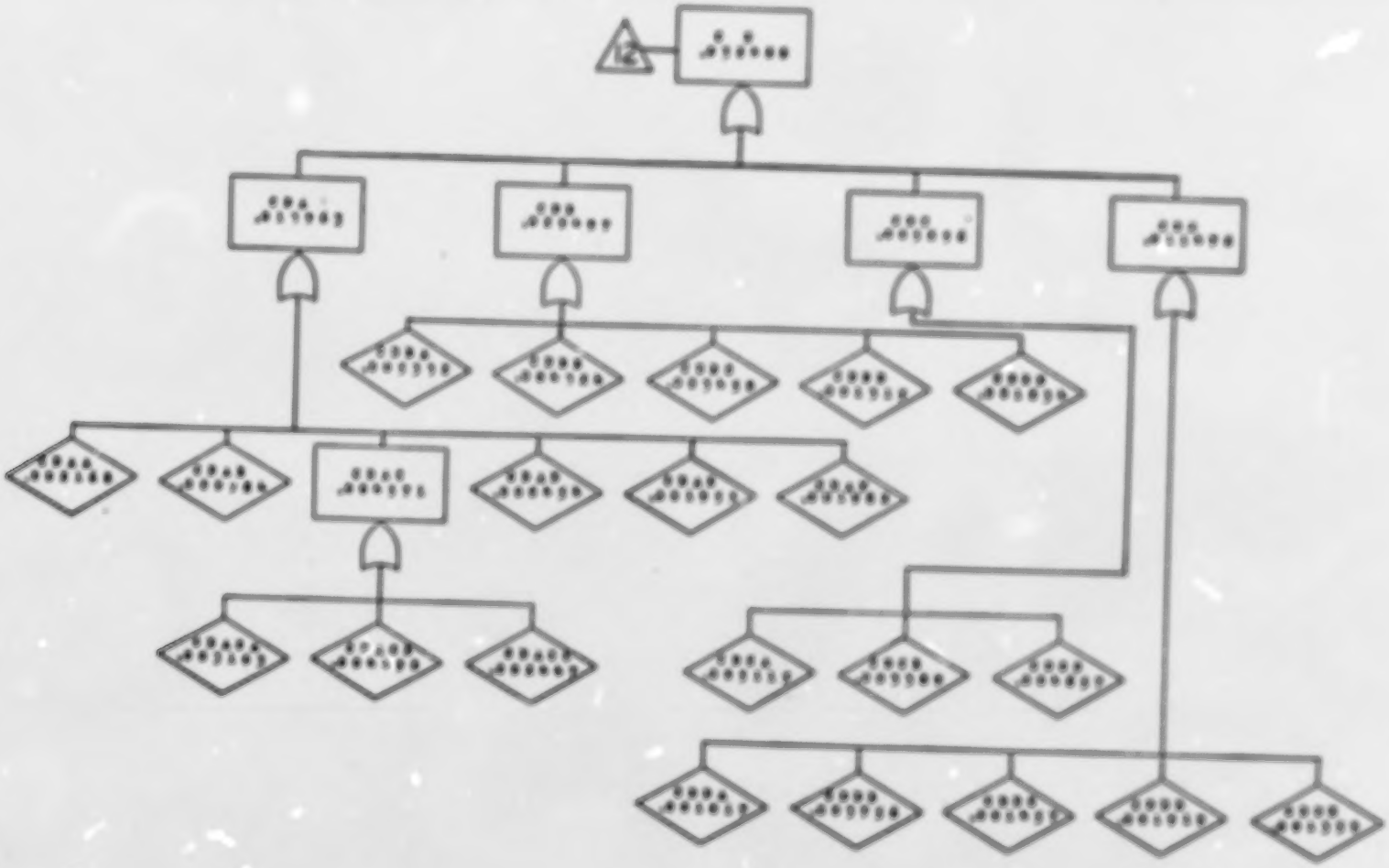

EVENTS	STATEMENTS
C	FAILURE OF MISSION BECAUSE OF INADEQUATE USE OF LEARNING RESOURCES DEVELOPMENT
CA	INADEQUATE USE OF LEARNING RESOURCES DEVELOPMENT BECAUSE OF A FAILURE TO EFFECTIVELY USE RESEARCH FUNCTION
CAA	INEFFECTIVE USE OF RESEARCH FUNCTION BECAUSE OF FAILURE TO ADEQUATELY IDENTIFY SUBJECT OF RESEARCH
CAAA	INADEQUATE IDENTIFICATION OF SUBJECT OF RESEARCH BECAUSE OF FAILURE TO USE RESEARCH ON LEARNER
CAAB	INADEQUATE IDENTIFICATION OF SUBJECT OF RESEARCH BECAUSE OF FAILURE TO USE RESEARCH ON UNITS OF INSTRUCTION
CAAC	INADEQUATE IDENTIFICATION OF SUBJECT OF RESEARCH BECAUSE OF FAILURE TO USE RESEARCH ON LEARNING RESOURCES
CAB	INEFFECTIVE USE OF RESEARCH FUNCTION BECAUSE OF FAILURE TO ADEQUATELY IDENTIFY PROCESS OF RESEARCH
CABA	INADEQUATE IDENTIFICATION OF PROCESS OF RESEARCH BECAUSE OF FAILURE TO USE THEORY CONSTRUCTION
CABAA	INADEQUATE THEORY CONSTRUCTION BECAUSE OF FAILURE TO PERCEIVE PROBLEM
CABAB	INADEQUATE THEORY CONSTRUCTION BECAUSE OF FAILURE TO MAKE PROBLEM DEFINITION
CABAC	INADEQUATE THEORY CONSTRUCTION BECAUSE OF FAILURE TO MAKE INFORMATION SYNTHESIS
CABB	INADEQUATE IDENTIFICATION OF PROCESS OF RESEARCH BECAUSE OF FAILURE TO USE THEORY TESTING
CABBA	INEFFECTIVE USE OF THEORY TESTING BECAUSE OF FAILURE TO FORMULATE HYPOTHESIS
CABBB	INEFFECTIVE USE OF THEORY TESTING BECAUSE OF FAILURE TO MAKE ADEQUATE REVIEW OF THE LITERATURE
CABBC	INEFFECTIVE USE OF THEORY TESTING BECAUSE OF FAILURE TO SELECT APPROPRIATE RESEARCH DESIGN
CABBD	INEFFECTIVE USE OF THEORY TESTING BECAUSE OF FAILURE TO SELECT APPROPRIATE RESEARCH SAMPLE
CABBE	INEFFECTIVE USE OF THEORY TESTING BECAUSE OF FAILURE TO SELECT APPROPRIATE RESEARCH RESOURCES
CABBF	INEFFECTIVE USE OF THEORY TESTING BECAUSE OF FAILURE TO GIVE EXPERIMENTAL TREATMENT

EVENTS	STATEMENTS
CABBG	INEFFECTIVE USE OF THEORY TESTING BECAUSE OF FAILURE TO APPROPRIATELY COLLECT AND ANALYZE DATA
CABBH	INEFFECTIVE USE OF THEORY TESTING BECAUSE OF FAILURE TO FORM CONCLUSIONS AND MAKE SUMMATION
CABBI	INEFFECTIVE USE OF THEORY TESTING BECAUSE OF FAILURE TO REPORT RESEARCH
CAC	INEFFECTIVE USE OF RESEARCH FUNCTION BECAUSE OF FAILURE TO IDENTIFY APPROPRIATE RESEARCH METHOD
CACA	INADEQUATE IDENTIFICATION OF APPROPRIATE RESEARCH METHOD BECAUSE OF FAILURE TO IDENTIFY PURE RESEARCH
CACAA	INADEQUATE IDENTIFICATION OF PURE RESEARCH BECAUSE OF FAILURE TO IDENTIFY ANIMAL/AUTONOMIC LEARNING RESEARCH STAGE
CACAB	INADEQUATE IDENTIFICATION OF PURE RESEARCH BECAUSE OF FAILURE TO IDENTIFY LEARNING PRINCIPLES STAGE
CACAC	INADEQUATE IDENTIFICATION OF PURE RESEARCH BECAUSE OF FAILURE TO IDENTIFY HUMAN LEARNING STAGE
CACB	INADEQUATE IDENTIFICATION OF APPROPRIATE RESEARCH METHODS BECAUSE OF FAILURE TO IDENTIFY APPLIED RESEARCH
CACBA	INADEQUATE IDENTIFICATION OF APPLIED RESEARCH BECAUSE OF FAILURE TO IDENTIFY DEVELOPMENTAL STAGE
CACBB	INADEQUATE IDENTIFICATION OF APPLIED RESEARCH BECAUSE OF FAILURE TO IDENTIFY PROTOTYPE STAGE
CACBC	INADEQUATE IDENTIFICATION OF APPLIED RESEARCH BECAUSE OF FAILURE TO IDENTIFY ADOPTION STAGE
CACC	INADEQUATE IDENTIFICATION OF APPROPRIATE RESEARCH METHODS BECAUSE OF FAILURE TO UNDERSTAND RESEARCH METHODS
CACCA	INADEQUATE UNDERSTANDING OF RESEARCH METHODS BECAUSE OF FAILURE TO KNOW HISTORICAL RESEARCH METHODS
CACCB	INADEQUATE UNDERSTANDING OF RESEARCH METHODS BECAUSE OF FAILURE TO KNOW DESCRIPTIVE RESEARCH METHODS
CACCC	INADEQUATE UNDERSTANDING OF RESEARCH METHODS BECAUSE OF FAILURE TO KNOW LOGITUDINAL RESEARCH METHODS

EVENTS	STATEMENTS
CACCD	INADEQUATE UNDERSTANDING OF RESEARCH METHODS BECAUSE OF FAILURE TO KNOW CASE AND FIELD RESEARCH METHODS
CACCE	INADEQUATE UNDERSTANDING OF RESEARCH METHODS BECAUSE OF FAILURE TO KNOW CORRELATION RESEARCH METHODS
CACCF	INADEQUATE UNDERSTANDING OF RESEARCH METHODS BECAUSE OF FAILURE TO KNOW CAUSAL-COMPARATIVE RESEARCH METHODS
CACCG	INADEQUATE UNDERSTANDING OF RESEARCH METHODS BECAUSE OF FAILURE TO KNOW EXPERIMENTAL RESEARCH METHODS
CACCH	INADEQUATE UNDERSTANDING OF RESEARCH METHODS BECAUSE OF FAILURE TO KNOW ACTION RESEARCH METHODS
CB	INADEQUATE USE OF LEARNING RESOURCES DEVELOPMENT BECAUSE OF FAILURE TO EFFECTIVELY USE THE DESIGN FUNCTION
CBA	INEFFECTIVE USE OF THE DESIGN FUNCTION BECAUSE OF FAILURE TO MAKE NEEDS ASSESSMENTS
CBB	INEFFECTIVE USE OF THE DESIGN FUNCTION BECAUSE OF FAILURE TO IDENTIFY INSTRUCTIONAL GOALS
CBC	INEFFECTIVE USE OF THE DESIGN FUNCTION BECAUSE OF FAILURE TO SPECIFY LEARNING OBJECTIVES
CBCA	INADEQUATE SPECIFICTION OF LEARNING OBJECTIVES BECAUSE OF FAILURE TO IDENTIFY STAGE OF LEARNING OBJECTIVES (Prerequisite, enabling or terminal objectives)
CBCB	INADEQUATE SPECIFICATION OF LEARNING OBJECTIVES BECAUSE OF FAILURE TO IDENTIFY DOMAIN OF LEARNING OBJECTIVES (Cognitive, Affective, Psychomotor)
CBD	INEFFECTIVE USE OF THE DESIGN FUNCTION BECAUSE OF FAILURE TO ANALYZE SETTINGS
CBE	INEFFECTIVE USE OF THE DESIGN FUNCTION BECAUSE OF FAILURE TO MAKE LEARNING TASK ANALYSIS
CBF	INEFFECTIVE USE OF THE DESIGN FUNCTION BECAUSE OF FAILURE TO MAKE LEARNER ANALYSIS
CBG	INEFFECTIVE USE OF THE DESIGN FUNCTION BECAUSE OF FAILURE TO SPECIFY INSTRUCTIONAL SEQUENCES
CBH	INEFFECTIVE USE OF THE DESIGN FUNCTION BECAUSE OF FAILURE TO MAKE ADEQUATE LEARNER ASSESSMENT

EVENTS	STATEMENTS
CBHA	INADEQUATE LEARNER ASSESSMENT MADE BECAUSE OF FAILURE TO IDENTIFY STAGE OF LEARNER ASSESSMENT (Pretest, Post test, Retention test, etc.)
CBHB	INADEQUATE LEARNER ASSESSMENT BECAUSE OF FAILURE TO IDENTIFY LEARNER REFERENT ASSESSMENT (Criterion-referenced, Norm-referenced, Domain-referenced)
CBI	INEFFECTIVE USE OF THE DESIGN FUNCTION BECAUSE OF FAILURE TO MAKE STATEMENTS OF DESIGN SPECIFICATIONS
CBJ	INEFFECTIVE USE OF THE DESIGN FUNCTION BECAUSE OF FAILURE TO SELECT APPROPRIATE PRESENTAITON FORMATS
CC	INADEQUATE USE OF LEARNING RESOURCES DEVELOPMENT BECAUSE OF FAILURE TO EFFECTIVELY USE THE PRODUCTION FUNCTION
CCA	INEFFECTIVE USE OF THE PRODUCTION FUNCTION BECAUSE OF FAILURE TO USE GRAPHIC PRODUCTION AND REPRODUCTION
CCB	INEFFECTIVE USE OF THE PRODUCTION FUNCTION BECAUSE OF FAILURE TO USE AUDIO/RADIO PRODUCTION
CCC	INEFFECTIVE USE OF THE PRODUCTION FUNCTION BECAUSE OF FAILURE TO USE STILL PHOTOGRAPHY
CCD	INEFFECTIVE USE OF THE PRODUCTION FUNCTION BECAUSE OF FAILURE TO USE MOTION PICTURE PRODUCTION
CCE	INEFFECTIVE USE OF THE PRODUCTION FUNCTION BECAUSE OF FAILURE TO USE TELEVISION PRODUCTION
CCF	INEFFECTIVE USE OF THE PRODUCTION FUNCTION BECAUSE OF FAILURE TO USE COMPUTER ASSISTED INSTRUCTION/AUTOMATED INSTRUCTION PRODUCTION
CD	INADEQUATE USE OF LEARNING RESOURCES DEVELOPMENT BECAUSE OF FAILURE TO EFFECTIVELY USE THE EVALUATION FUNCTION
CDA	INEFFECTIVE USE OF THE EVALUATION FUNCTION BECAUSE OF FAILURE TO DETERMINE ASPECTS OF EVALUATION
CDAA	INADEQUATE DETERMINIATION OF ASPECTS OF EVALUATION BECAUSE OF FAILURE TO EVALUATE ASPECTS OF LEARNING RESOURCES
CDAB	INADEQUATE DETERMINATION OF ASPECTS OF EVALUATION BECAUSE OF FAILURE TO EVALUATE ASPECTS OF DEVICES

EVENTS	STATEMENTS
CDAC	INADEQUATE DETERMINATION OF ASPECTS OF EVALUATION BECAUSE OF FAILURE TO EVALUATE ASPECTS OF TECHNIQUES
CDACA	INEFFECTIVE EVALUATION OF TECHNIQUES BECAUSE OF FAILURE TO EVALUATE FOR COMPATABILITY WITH LEARNERS
CDACB	INEFFECTIVE EVALUATION OF TECHNIQUES BECAUSE OF FAILURE TO EVALUATE FOR COMPATABILITY WITH LEARNING OBJECTIVES
CDACC	INEFFECTIVE EVALUATION OF TECHNIQUES BECAUSE OF FAILURE TO EVALUATE FOR COMPATABILITY WITH LEARNING RESOURCES
CDAD	INADEQUATE DETERMINATION OF ASPECTS OF EVALUATION BECAUSE OF FAILURE TO EVALUATE ASPECTS OF SETTINGS
CDAE	INADEQUATE DETERMINATION OF ASPECTS OF EVALUATION BECAUSE OF FAILURE TO EVALUATE ASPECTS OF CONTENT
CDAF	INADEQUATE DETERMINATION OF ASPECTS OF EVALUATION BECAUSE OF FAILURE TO EVALUATE ASPECTS OF UNITS OF INSTRUCTION
CDB	INEFFECTIVE USE OF THE EVALUATION FUNCTION BECAUSE OF FAILURE TO DETERMINE EVALUATION FOR REVISION
CDBA	FAILURE TO DETERMINE PURPOSES OF EVALUATION BECAUSE OF FAILURE TO DETERMINE EVALUATION FOR REVISION
CDBB	FAILURE TO DETERMINE PURPOSES FOR EVALUATION BECAUSE OF FAILURE TO DETERMINE EVALUATION FOR ADOPTION
CDBC	FAILURE TO DETERMINE PURPOSES FOR EVALUATION BECAUSE OF FAILURE TO DETERMINE EVALUATION FOR CONTINUED USE
CDBD	FAILURE TO DETERMINE PURPOSES OF EVALUATION BECAUSE OF FAILURE TO DETERMINE EVALUATION FOR COST EFFECTIVENESS
CDBE	FAILURE TO DETERMINE PURPOSES OF EVALUATION BECAUSE OF FAILURE TO DETERMINE EVALUATION FOR COST BENEFIT
CDC	INEFFECTIVE USE OF THE EVALUATION FUNCTION BECAUSE OF FAILURE TO IDENTIFY STAGES OF EVALUATION
CDCA	INADEQUATE IDENTIFICATION OF STAGES OF EVALUATION BECAUSE OF FAILURE TO RECOGNIZE AND USE VALIDATED TESTING
CDCB	INADEQUATE IDENTIFICATION OF STAGES OF EVALUATION BECAUSE OF FAILURE TO RECOGNIZE AND USE FIELD TESTING
CDCC	INADEQUATE IDENTIFICATION OF STAGES OF EVALUATION BECAUSE OF FAILURE TO RECOGNIZE AND USE DEVELOPMENTAL TESTING

EVENTS	STATEMENTS
CDD	INEFFECTIVF USE OF THE EVALUATION FUNCTION BECAUSE OF FAILURE TO USE SOURCES OF EVALUATION DATA ADEQUATELY
CDDA	INADEQUATE USE OF SOURCES OF EVALUATION DATA BECAUSE OF FAILURE TO USE EXPERT OPINION
CDDB	INADEQUATE USE OF SOURCES OF EVALUATION DATA BECAUSE OF FAILURE TO USE REVIEWS/LITERATURE
CDDC	INADEQUATE USE OF SOURCES OF EVALUATION DATA BECAUSE OF FAILURE TO MAKE USER SURVEYS
CDDD	INADEQUATE USE OF SOURCES OF EVALUATION DATA BECAUSE OF FAILURE TO USE SYSTEMATIC PERSONAL OBSERVATIONS
CDDE	INADEQUATE USE OF SOURCES OF EVALUTION DATA BECAUSE OF FAILURE TO USE CONTROLLED TESTING
CE	INADEQUATE USE OF LEARNING RESOURCES DEVELOPMENT BECAUSE OF FAILURE TO EFFECTIVELY USE UTILIZATION FUNCTION
CEA	INEFFECTIVE USE OF UTILIZATION FUNCTION BECAUSE OF FAILURE TO SELECT APPROPRIATE MATERIALS MATCHING LEARNING RESOURCES TO LEARNERS AND OBJECTIVES
CEB	INEFFECTIVE USE OF UTILIZATION FUNCTION BECAUSE OF FAILURE TO MARCH GROUP SIZE TO INSTRUCTIONAL TECHNIQUES
CEC	INEFFECTIVE USE OF UTILIZATION FUNCTION BECAUSE OF FAILURE TO MODIFY LEARNING RESOURCES TO MEET LEARNER NEEDS
CED	INEFFECTIVE USE OF UTILIZATION FUNCTION BECAUSE OF FAILURE TO DETERMINE APPROPRIATE PACING
CEE	INEFFECTIVE USE OF UTILIZATION FUNCTION BECAUSE OF FAILURE TO APPROPRIATELY PREPARE FOR USE OF LEARNING RESOURCES
CEF	INEFFECTIVE USE OF UTILIZATION FUNCTION BECAUSE OF FAILURE TO PREPARE LEARNERS FOR USING LEARNING RESOURCES
CEG	INEFFECTIVE USE OF UTILIZATION FUNCTION BECAUSE OF FAILURE TO EFFECTIVELY MONITOR LEARNER PROGRESS
CEH	INEFFECTIVE USE OF UTILIZATION FUNCTION BECAUSE OF FAILURE TO FACILITATE LEARNER RESPONSES
CEI	INFFFECTIVE USE OF UTILIZATION FUNCTION BECAUSE OF FAILURE TO ASSESS LEARNING

EVENTS	STATEMENTS
CEJ	INEFFECTIVE USE OF UTILIZATION FUNCTION BECAUSE OF FAILURE TO REMEDIATE LEARNING DEFICIENCIES
CF	INADEQUATE USE OF LEARNING RESOURCES DEVELOPMENT BECAUSE OF FAILURE TO EFFECTIVELY USE DISTRIBUTION SYSTEMS
CFA	INEFFECTIVE USE OF DISTRIBUTION SYSTEMS BECAUSE OF FAILURE TO ACQUIRE APPROPRIATE LEARNING RESOURCES
CFB	INEFFECTIVE USE OF DISTRIBUTION SYSTEMS BECAUSE OF FAILURE TO APPROPRIATELY SCHEDULE USE OF LEARNING RESOURCES
CFC	INEFFECTIVE USE OF DISTRUBITION SYSTEMS BECAUSE OF FAILURE TO SELECT APPROPRIATE DISTRIBUTION SYSTEMS
CFCA	INEFFECTIVE SELECTION OF DISTRIBUTION SYSTEMS BECAUSE OF FAILURE TO SELECT MANUAL DELIVERY SYSTEMS
CFCB	INEFFECTIVE SELECTION OF DISTRIBUTION SYSTEMS BECAUSE OF FAILURE TO SELECT ELECTRONIC DISTRIBUTION SYSTEMS
CFCBA	INEFFECTIVE USE OF ELECTRONIC DISTRIBUTION SYSTEMS BECAUSE OF FAILURE TO USE RADIO DISTRIBUTION
CFCBB	INEFFECTIVE USE OF ELECTRONIC DISTRIBUTION SYSTEMS BECAUSE OF FAILURE TO USE TELEVISED DISTRIBUTION
CFCC	INEFFECTIVE SELECTION OF DISTRIBUTION SYSTEMS BECAUSE OF FAILURE TO SELECT LIBRARY/MEDIA CIRCULATION SYSTEMS

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